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AERIAL AGE

WEEKLY

Vol. 15, No. 1

MARCH 13, 1922

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Remarkable Airscape of Niagara Falls Taken from an Altitude of 800 Feet

Plans of the Aeronautical Chamber of Commerce—
Aerial Photography—Operation of Aero-
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The Leading Technical and Trade
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To AERIAL AGE WEEKLY

280 Madison Ave., New York

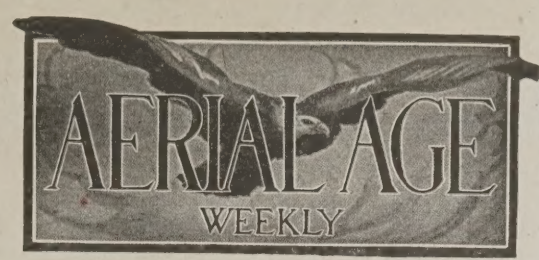
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March 13, 1922



Vol. XV, No. 1

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Printed in U. S. A.

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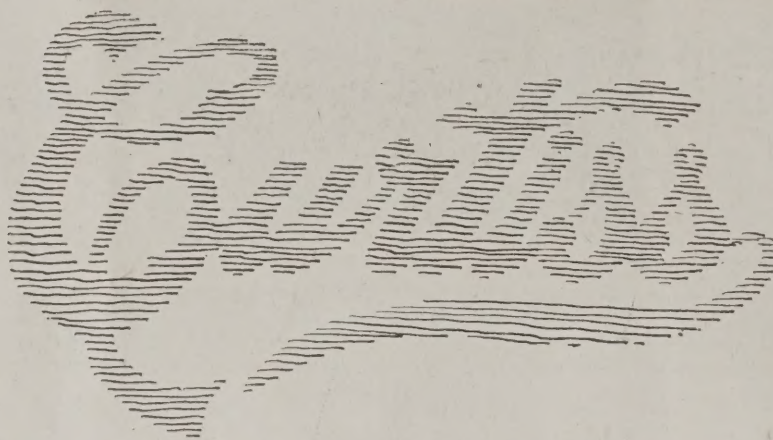
- Paris — London, 1919, 1920, 1921, 1922
- Paris — Brussels, 1919, 1920, 1921, 1922
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With K-6 Motor (1919)		4400.00 F.O.B. Buffalo, New York
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SEAGULL:		
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Without motor, rebuilt for OX5	1100.00	F.O.B. Houston, Texas
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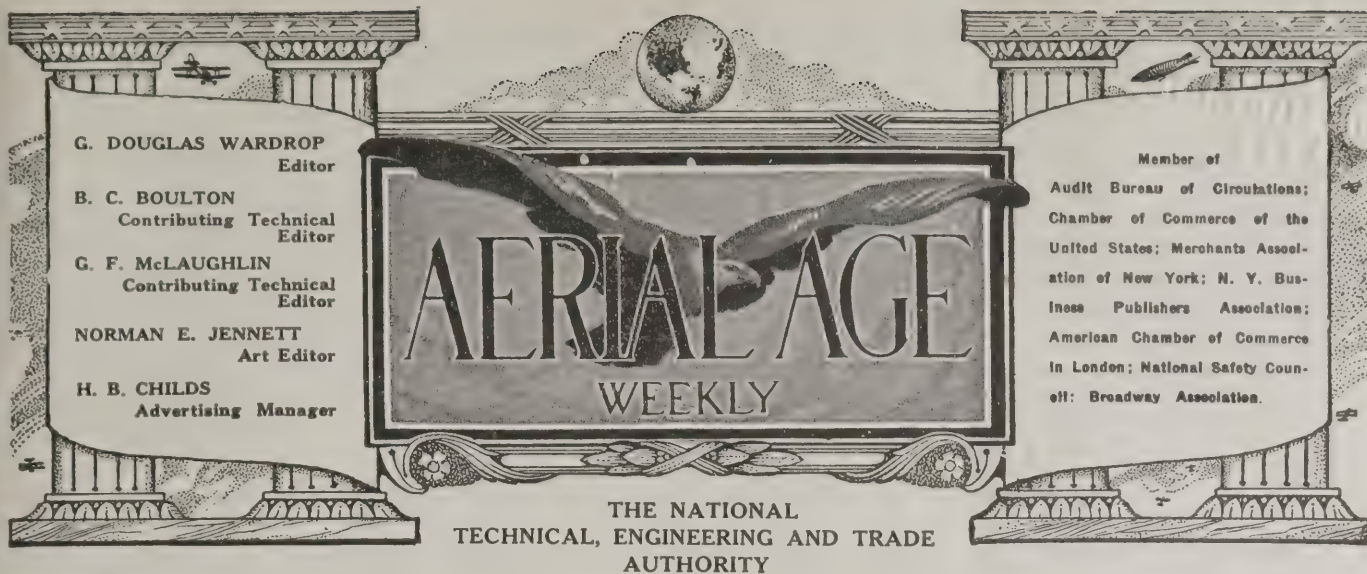
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CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY



LONG ISLAND, N. Y.



With which Flying is consolidated

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City
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VOL. XV

NEW YORK, MARCH 13, 1922

No. 1

Plans of the Aeronautical Chamber of Commerce

UNDER the influence of a largely increased, and widely distributed membership, encompassing the entire American aeronautic industry, the Aeronautical Chamber of Commerce seem now to be in a position to render the industry service for which there has long been a need.

The Aeronautical Chamber of Commerce proposes to aid in the fulfilment of the common desire of all of the members by "*Selling Aviation*" not only to the American public but to foreign markets, wherever they may be. It proposes to act in three general channels as follows:

- 1—Co-operation with the various Departments and Bureaus of the Government at Washington, having to do with aviation at home and abroad.
- 2—The promotion of Flying Meets, Demonstrations and Aeronautical Shows.
- 3—The holding at intervals, of at least once a year, an Aeronautical Institute, possibly in conjunction with an aeronautical show or flying meet, to be conducted by and for the Engineers and Designers, for the purpose of exchanging thought on scientific development in the art and making such development available for public education.

The first and third points are admirable, but some care and attention will have to be devoted to the second point. It is the function of the Aero Club of America, through its representation of the International Aeronautic Federation, to sanction and govern well regulated flying meets, and for the benefits of the pilots participating in contests, the Aeronautical Chamber of Commerce will do well to co-operate with the Aero Club on this matter. According to the F.A.I. regulations, a meet cannot be sanctioned until the prize money offered has been deposited in a bank, and application for sanction of a meet must be accompanied by evidence of such deposit of funds. This is a plan which cannot be improved upon. But the Aeronautical Chamber of Commerce will be in a position to encourage its manufacturing members to show an increasing interest in outdoor events, and this should result in our having a greater number of contests and outdoor events than we had in 1921. If we are ever to sell aviation to the public we must have such outdoor demonstrations throughout the entire country, and the knowledge that the Chamber of Commerce is going to co-operate in this matter will be welcomed by everyone interested in the development of American aeronautics.

The new Board of Governors of the Aeronautical Chamber of Commerce is well balanced, and gets a lot of good new blood into the administrative affairs of aeronautics. AERIAL AGE extends to the Board its cordial good wishes for a successful administration and assures its members of its most hearty co-operation in its plans for the selling of aeronautics to the American people.

The Aerial Mail Appropriation

THE Senate sub-committee considering the Postoffice Appropriation Bill has agreed to vote \$1,900,000 for the aerial mail service, but this appropriation for the trans-continental route must still run the gauntlet of the Senate, and the Senate in conference with the House, which struck out the item from the Postoffice Bill.

One hundred and five of the larger cities in the country have petitioned the Government to provide them with an Air Mail service.

The Air Mail planes cost practically nothing, as most of those in use have been obtained from the surplus supply of the United States Army, which otherwise would eventually have been scrapped, without use, due to deterioration through old age.

If the Air Mail service were discontinued, civilian, military and commercial aviation would suffer an almost irreparable loss, as the Air Mail service operating all the year round from the Atlantic to the Pacific gives:

- (1) Research work embracing all phases of practical flying and a knowledge of the air conditions across the Continent during all seasons of the year (Military aviation is confined in winter to the fields in the sunny South).
- (2) It maintains a trans-continental Air Highway which will be used by civilian and commercial aircraft and can be used by military aircraft in case of an emergency. The aerodromes, hangars and shop facilities of this highway would be lost to aviation without the Air Mail.
- (3) The Air Mail service has and is developing the best group of practical aviators in this country, flying, as they are daily, cross country under anything but impossible flying conditions. Their experience and "flying sense" will be invaluable for the training of future pilots, and their practical experience of inestimable value to the engineers and constructors.

Civilian and commercial aviation will suffer a deplorable setback if the Air Mail is abandoned. Congress realized this a year ago, when the same committee cut the Air Mail appropriation. It was partly restored.

The National Advisory Committee for Aeronautics has urged the continuation and development of the Air Mail.

Your duty is clear. Support the National Advisory Committee in supporting the Air Mail, by writing or telegraphing your representative in Congress.



THE NEWS OF THE WEEK



La Guardia New Air Police Chief

Colonel F. H. La Guardia, formerly President of the Board of Aldermen, has been appointed the new commander of the aviation division of the New York Police Reserves by Special Police Commissioner Rodman Wanamaker. Colonel La Guardia served with the American Air Forces on the Italian front during the World War.

Commenting on his appointment, Colonel La Guardia said that it was his intention to develop the aviation division to the highest possible standard, and that his first step would be to enroll one hundred additional cadets to be trained as pilots at the Rodman Wanamaker Aviation School.

Aero Club of Pittsburgh

The Aero Club of Pittsburgh have recently opened offices at 1212 Jones Building, Pittsburgh, and A. H. Krigger has been appointed business manager. Aircraft companies are requested to send copies of catalogs and publicity material for the library which the club is inaugurating.

One Resting-Place for Lafayette Flying Corps

An echo of the tragedy of the late War is the bringing into one burying-ground in France the Americans who fell fighting whilst with the famous Lafayette Flying Corps. According to the *Pall Mall Gazette*, the French Government have decided to provide a plot and arrange for the reinterment of the bodies of more than forty heroes who lie buried in different parts of Europe.

The maintenance of the graves and the erection of headstones will be undertaken by survivors of the famous corps. Of the 186 members of the Lafayette Flying Corps who went to the front, 63 were killed. The bodies of six of these have not been recovered.

Among the bodies to be placed in the new cemetery, which is situated near Souain, is one recovered on the shores of the North Sea, one in Salonika, and one in Genoa.

The cemetery will not be military in character, but will be as simple as an American country graveyard.

W. J. B. Takes Flight

William Jennings Bryan had his first aeroplane ride on February 23 when he travelled from Jacksonville to Palm Beach.

Spokane News

Spokane, Wash.—Opening of a new municipal aviation field at Spokane under the direction of the Foster-Russell Aviation Company has been authorized by the park board. The new field will be situated toward the east end of Upriver park, at a point removed from the aviation field occupied for the last two years by the United States Aircraft company, headed by C. H. Messer.

The lease to the United States Aircraft company has not been renewed, but it is suggested that the company still operate if it agreed to satisfactory arrangements with the park board.

Under the proposal of the Foster-Russell company his firm will install markers, make needed preliminary improvements

and transfer the great part of its flying operations to the field this year. For the second year the company will pay \$100, for the third year \$200 and increase the payment \$100 each year so long as the arrangement continues. These fees, together with all fees paid by private aeroplane owners for the use of the grounds, are to be spent in improvements. All fees to be paid are to be determined by the park board.

Mr. Russell stated that the aviation field now in use at Upriver park is a poor one-way or third-class field, while on the site proposed to be developed a four-way or first-class field can be laid out.

Southern Club of California Notes

C. Harding Babb of the Aero Club and H. E. Patterson of Venice, Cal., recently completed a trip to Lincoln, Nebraska. Leaving Los Angeles, Cal., in a Martin Bombing plane, early in the month, they took the southern route, flying by way of Tucson, Arizona; Douglas, New Mexico; El Paso, Texas; Fort Worth, Texas, and Lincoln, Nebraska. The ship is to be completely remodeled for commercial aviation by The Nebraska Aircraft Corporation.

The return trip in a new Lincoln Standard was made in 26 hours flying time, making stops at Oklahoma City, Wichita, Fort Worth, El Paso, Douglas, Tucson, Yuma and Los Angeles.

Considering business conditions and the weather, commercial flying in Southern California has been fair. Most of the fields do a good deal of motion picture work, not a little photography and considerable cross country.

Recently an aeroplane was employed to drop snow shoes and food to a motion picture set who were snowed in while shooting a scene high up in the Sierras.

Mr. Fisk, of Catron and Fisk, has just completed his large twin-motored triplane and has employed E. L. Remelin, formerly of Rogers Airport and Mercury, as test pilot. Mr. Remelin says that the ship performs very well and will carry a full load with one motor cut out entirely. Mr. Fisk expects to inaugurate an airline to Bakersfield in the near future. The ship is a six-passenger ship.

Predicts Success of Air Freight Service Between New York and Chicago

Aircraft executives of Aeronautical Companies in the vicinity of New York City were addressed by R. E. M. Cowie, Vice-President of the American Railway Express Company, at their semi-monthly luncheon, held at the Cafe Boulevard, New York, March 3rd.

Mr. Cowie was introduced to the executives by R. R. Blythe, Chairman of the luncheon and who is Aviation Manager of the insurance firm of Johnson and Higgins. "I have been studying aircraft in relation to express transit," said Mr. Cowie, "for the past five years. There is no doubt in my mind but that aircraft will take a prominent place in the transportation of fast freight. Such an airway to be successful must be between two points where the time element plays a prominent part. I have in mind New York City and Chicago. If there was an aircraft company organized and capable of maintaining a service leaving

New York at night and arriving at Chicago in the morning, I would not hesitate to recommend that we enter into some co-operative idea for the shipment of freight by air.

"For instance, Manhattan Island is covered with our stations. I would not hesitate to advertise that up to 6 P. M. freight for Chicago could be delivered to any of these depots. Promptly at six one of our trucks would start from the top of Manhattan Island and another from the Battery making a complete round of our stations collecting the freight and disposing of it at a central station, from which point a fast truck would run out to the flying field. At this field, there would be four or five baskets numbered consecutively. I would have a man familiar with the Chicago distributing points who would place the freight in the respective baskets. Before the propeller stopped turning in Chicago the following morning the freight would be distributed among similar baskets and the New Yorker, at the Blackstone Hotel for instance, would have his New York paper delivered with his breakfast.

"I feel sure that newspaper publishers would take very kindly to this idea."

Mr. Cowie emphasized his faith in the future of commercial aviation. Inasmuch as the Parcel Post service grew from practically nothing to the present huge scale, he believed that so would express freight by air on the other hand become exceedingly popular.

Executives from the following companies attended the luncheon: Aeromarine Engineering and Sales Co., Aeromarine Airways, Curtiss Aeroplane and Motor Corporation, Netherland Aircraft Co., Gallaudet Aircraft Co., J. L. Aircraft Co., Wright Aeronautical Co., Pioneer Instrument Co., Fairchild Aerial Camera Co., Aeronautical Chamber of Commerce, Maxwell Aerial Photograph Co., Aerial Age and Aviation Publishing Companies.

Act to Continue Air Mail

Washington.—Funds to continue the transcontinental air mail service and to restore the New York City pneumatic postal tube system are to be provided in the annual Post Office Appropriation Bill under agreements reached by Senate committee members in charge of the measure. In passing the bill, the House refused to provide for either of these services, and former Postmaster-General Hays recently appeared before the Senate Committee in their behalf.

The Senate sub-committee considering the bill has agreed to vote \$1,900,000, almost the sum requested by Mr. Hays for the transcontinental aerial mail service. The proposed appropriation for the transcontinental route must run the gauntlet both of the Senate and in conference with the House.

Autograph Oil Representation

S. M. MacDonald and A. L. Haskell, well known to the automotive trade as manager and assistant manager respectively of the Boston office of the New York Lubricating Oil Co., will actively represent the National Lubricants Co., makers of autograph lubricants, in New England.

The AIRCRAFT TRADE REVIEW

Curtiss Planes in Argentina

A report received from the Curtiss Aeroplane Export Corporation, of New York City, covering operations in Argentina, states that during the year 1921, Curtiss machines, of which there are about 26 or 30 in operation, carried a total of 5,788 passengers and covered 316,725 kilometers (which is roughly 195,000 miles). Not the slightest accident occurred, excepting one broken landing gear and propeller on account of a forced landing in a thick fog. A total of 21 civilian students were trained at the Curtiss Field, and Curtiss machines and motors flew a total of 2,434 hours. British, French and Italians have airdromes and schools of their own in Argentina, and the Curtiss people flew more hours, trained more men and covered more distance than all of them combined.

Registered Pilots and Registered Aircraft

The Underwriters Laboratories of Chicago, Ill., in cooperation with the National Aircraft Underwriters Association, has opened Registers of aircraft pilots and of aircraft. The plan is based upon the provisions of the Convention relating to International Air Navigation agreed upon, subject to certain reservations, by representatives of the Allied and Associated Powers serving on the International Commission of the Peace Conference. The plan very closely, follows the Air Regulations of the Canadian Air Board.

Easter Airways Purchase Two Additional Aeromarine Flying Boats to Inaugurate New Service

That there will be a great deal of activity in flying boats this year was the prediction made by Henry A. Bruno, Sales and Advertising Manager of the Aeromarine Engineering & Sales Company after announcing the sale of two Aeromarine-Navy H.S. flying boats to the Easter Airways, Inc., of Baltimore, Md., of which P. E. Easter is President.

Mr. Easter is a former army flyer and during the winter months of 1920-1921 operated a small two-plane boat at St. Augustine, Florida. In the spring, he returned to Baltimore and realized that he needed more efficient equipment. After analyzing the flying boats on the market at that time, he purchased one of the six-seat, open cockpit, Aeromarine-Navy H.S. flying boats powered with a single Liberty engine.

During the summer he made many regular trips from Easton to Baltimore and demonstrated the safety and practicability of flying boat travel. Operations were suspended during the past winter but, due to the enviable record Mr. Easter made with this one boat, considerable interest was aroused among prominent business men in Baltimore. As a result of this interest, a new company has recently been formed known as the Easter Airways, Inc. The directors of this company are all big business men of Baltimore—they have expressed their confidence in Mr. Easter and his method of operating, and as a result of the increased capitalization, Mr. Easter placed his order for two additional Aeromarine-Navy H.S. flying boats.

"While it is too early at the present time to definitely state our plans," said Mr. Easter recently, "we have in mind the operation of a regular line between Baltimore and Norfolk, taking in also the eastern shore of Maryland.

My reason for continuing to use this type of flying boat was because of the excellent way the first one has performed and also because I realize that there is no flying boat on the market today that can compare with it for low cost of operating and earning possibilities.

While I must admit I have been influenced in making this second purchase to a great extent by the splendid performance of my first boat, I wish to state also that the way the same type boats have performed in their operations for the Aeromarine Airways has doubly convinced me that I have made a good deal for all concerned.

Over-water flying has a fascination and a charm for the general public which makes it easier for us to secure passengers. Our operating bases will be at strategic points and our cost of securing passengers will naturally be much less than if we were located at some inaccessible points."

Mr. Easter will take delivery of the first of these two new boats within the next ten days, flying it down to Baltimore from the Aeromarine factory at Keyport, N. J.

First Municipal Air Map Contract

The Fairchild Aerial Camera Corporation of New York has been awarded a contract by the city of Newark for an aerial photographic map of Newark and vicinity, the first such contract entered into by a city on the Atlantic seaboard.

The map will cost \$4,600 and will include eighty-two items, principally a major map of the city from an altitude of 5,000 feet. The map will be seven feet square. Special attention will be paid to the Port Newark development and a set of photographs will be made of Newark Bay and Kill van Kull and out to sea. The maps and pictures will be used in a campaign to sell port property owned by the city to manufacturing plants.

House Turns Down \$150,000 For Helium

With less than 100 members on the floor an amendment which would have made \$150,000 available for the development of helium with a view to using it to fill dirigibles, was rejected by a two to one vote in the House of Representatives March 3. The amendment was offered by Representative Lanham (Dem., Tex.). The recent Roma disaster never would have occurred, Mr. Lanham declared, if the airship had been filled with helium instead of hydrogen.

The helium plant at Fort Worth, said to be the only one in the world capable of producing the gas in large quantities, has been closed since November 30, Mr. Lanham said, because funds have not been available to continue operations.

Mr. Madden opposed the amendment on the ground that the sub-committee drafting the army appropriation bill was making an investigation to determine what appropriation should be made for helium development.

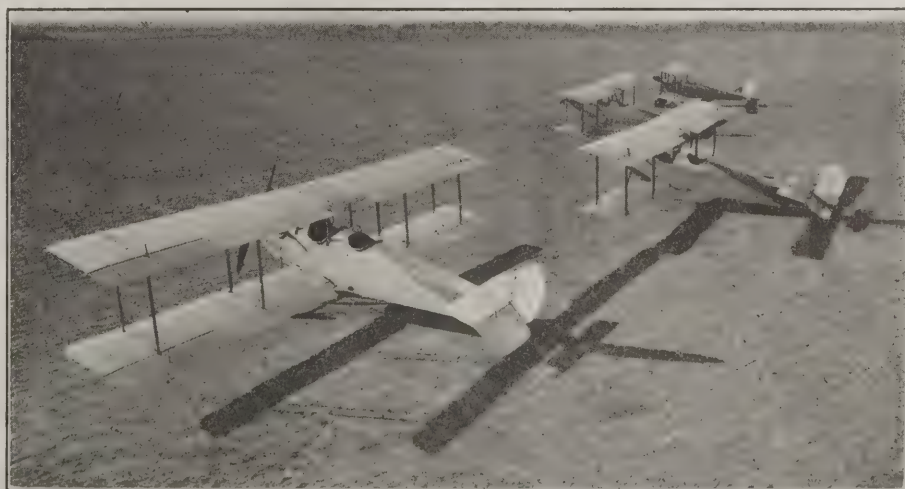
Chairman Anthony of the sub-committee which is studying the helium situation said more than \$10,000,000 had been expended since the beginning of the war in experiments with the gas and in developing the plant at Fort Worth.

Mr. Anthony's estimate that it would have cost \$1,200,000 to fill the Roma with helium was challenged by Mr. Lanham, who declared the cost would not have been more than \$216,000.

Tests on Air Propellers in Yaw

This report by W. F. Durand and E. P. Lesley, contains the results of tests to determine the thrust (pull) and torque characteristics of air propellers in movement relative to the air in a line oblique to the line of the shaft, and specifically when such angle of obliquity is large, as in the case of helicopter flight with the propeller serving for both sustentation and traction.

A copy of Report No. 113 may be obtained upon request from the National Advisory Committee for Aeronautics.



A group of Laird Swallows on the E. M. Laird Field just after flight test

AERIAL PHOTOGRAPHY

By W. L. HAMILTON

AMERICA has added another important invention to her rapidly increasing number of distinctive achievements in aviation. It is the perfected aerial camera which has just given a remarkable demonstration of efficiency in a photograph of New York City from the air. Municipal engineers say it will save many thousands of dollars and years of engineering work in effecting public improvements. The photograph is more than 8 feet long and 20 inches wide. It shows more than 32 square miles of the metropolis, every street, building, vehicle and person out of doors, just as one would see if looking down straight upon it from a position high overhead.

The machine which made the photograph possible is a big camera with several new devices invented by Sherman M. Fairchild, President of the Fairchild Aerial Camera Corporation, 136 West Fifty-second Street, New York. His experiments the last three years have been directed toward making the camera accurate and economical, the main essentials in practical commercial photography, particularly aerial maps such as that of New York.

Inaccuracy has been the chief difficulty with various kinds of apparatus employed heretofore. Many technical problems were overcome by the Fairchild inventions which so improved the mechanism and actual work of this new camera that the results were better than 99 per cent accurate—more than sufficient for all practical purposes, according to municipal officials and engineers and those of large corporations who see in this development limitless possibilities for saving time and money in many branches of their work.

The New York photograph is a vertical one; that is, it was taken from an aeroplane flying directly overhead, and is known technically as a mosaic; or aerial map. Using a film similar to the ordinary camera, though larger, and regulating its exposure by means of an electric timing device gauged to the relative speed of the aeroplane from which the camera was operated, Fairchild succeeded in removing the hundred and one difficulties which have delayed commercial progress in this kind of mapping.

Plotting the city into rectangular sections of a scale so that each section could be photographed individually from the plane right over its exact center, the entire city from the Battery to Van Cortlandt Park was divided into 100 parts. Each of them was photographed. The hundred photographs were taken in a single flight of 69 minutes. As the plane passed over the center of each rectangular section there was an automatic click of the camera, and the film automatically rolled into position for another exposure a few seconds later. When the sections had all been "snapped", Fairchild had 100 photo-

graphs, all together totalling an area of approximately 32 square miles. They were then fitted together like a picture puzzle and mounted on cardboard—and there lay New York, with everything out of doors plainly visible and accurate in size and location.

The Battery, Madison Square, Fifth Avenue, Central Park, the office buildings, motor cars, roofs of factories, mansions and tenements, smoke-belching chimneys and the oil-flecked waterfront, with the various centers of population and dense traffic portrayed in true proportions and convincingly—all at a glance, all this and more developed in one picture. When it was shown to city officials, they were amazed.

"Why, this seems to be the only method by which we can secure first-hand information about the city; and it is the quickest and most inexpensive thing I ever heard of", said a city engineer.

At New York Police Headquarters, Inspector Davis said, "If I had had an aerial survey of my precinct, I could have sat at my desk and determined the location and details of every roof exit, scuttle hole and skylight, had all that information right in front of me. It would have been a great help to us in directing a raid or surrounding a burglar."

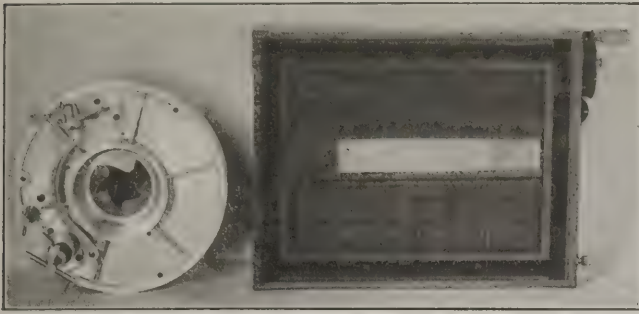
Commissioner Joseph Johnson of the Department of Public Works said that he had intended motoring out to inspect two proposed operations but that with the map on his desk he could attend to it there in a few moments. Nelson P. Lewis of the Russell Sage Foundation, and noted city planner, believes that in the future the aerial map will be used in all city planning operations as it will enable them to plot the most direct routes, locate obstacles, determine the number of over-heads and short cuts, and lead traffic up through the city and out into the suburbs. He said:

"A relief map in the study of any territory looking to its best development would be of the greatest value, but that could be made only after the collection of accurate information and as the result of field surveys. If then, without equipping survey parties and spending weeks and months laboriously collecting information, which is later to be used in these relief maps and models, we can, in as many days, obtain accurate information from an aerial photograph, or mosaic, it is quite evident that a great advance has been made in planning for the future development not only of cities but also of suburban and rural districts." At the office of the Borough President, it is planned to use the aerial camera to determine, through calculating distances by interval exposures, just how far groups of traffic can proceed for a given period of time with the least interference.

The possibilities and practical value of aerial maps and



The Central Park section of the New York map. Note in the Columbus Circle district the lack of shade on the paths, which shows to great advantage the need of reforestation in Central Park



The Fairchild between the lens shutter designed to expose the entire plate in 1/150 of a second, thereby eliminating distortion introduced by movement of the plane. At the right is the old style curtain shutter which exposes the width of its own slit in 1/150 of a second, which has to be multiplied by the width of the plate to determine the entire exposure. In some cases, the actual exposure of the focal plane shutter will be reduced to 1/15 of a second, thereby permitting the plane to travel sufficient distance to distort the picture and make it impossible to accurately join the mosaic

photographs are limitless, say experts, who point out that since they first came into use during the World War, thousands of ways have been discovered for making them distinctly important—and relatively inexpensive—in all commercial and industrial fields.

Like many notable inventions, applied photography from the air is accredited to accident. It appears that a private soldier, in the early days of the war, secured a ride in a battle plane flying over the front. Against the rules he took along his little camera and snapped whatever he saw below that interested him. On landing his films were confiscated by officers, who to their astonishment found that the negatives provided them with accurate and detailed information which even the trained eyes of the observers had missed. It was a permanent record, that set of photographs, could be studied and interpreted by many eyes, many minds, quickly, hastily, or at leisure, whenever opportunity arose or occasion demanded. One would see an important detail; another would learn something that affected his plan and therefore of immediate and urgent importance to him, thus originated aerial photography. Continued expansion of the idea has resulted in cameras being made that will take detailed photographs from an altitude of 35,000 feet, though for special commercial work such as the New York map, 10,000 feet is considered most economical. But 5,000 feet altitude is most efficient for portraying everything below more clearly than one might see it with the naked eye. Aerial photographs taken from an angle are termed oblique views and often are effective from the pictorial viewpoint. To the person studying the oblique photograph, it is the same as occupying a grandstand seat in the sky, with the panorama laid out before him and receding in the distance.

The aerial map, or mosaic, or vertical view, as it is variously known, is a different thing. It requires an equality of detail throughout and over large areas, while the oblique loses the detail in the background. The details diminish with great rapidity and, due to the angle at which the picture is taken, will not permit of overlapping or joining consecutive areas.

On the other hand the angles of the vertical picture are symmetrical and permit the overlapping of a large number of photographs, thereby covering great areas and maintaining equality in detail. That is the mosaic, or aerial map for which the Fairchild camera is peculiarly adapted. It secures accuracy over unlimited areas.

To secure this accuracy, Fairchild developed what is known as the between-the-lens shutter, which actually saves the brief instant which other shutters spend traversing the plate during the exposure. This instant would matter little in ordinary photography but in mapping, or making vertical shots, the speed of the aeroplane would cause a distortion in the map. The focal plane shutter has been used in the past and serves its purpose for oblique views which do not require accuracy. The between-the-lens shutter exposes the entire plate in 1/150 seconds and it can be seen that the plane has traveled no distance in that instant. The whole plate is exposed at once, instantly, and from the same position, while the focal plate shutter, though its speed may be rated 1/150 second, actually exposes part of the plate only in this time. That part or portion exposed is only the actual width of the slit in the shutter curtain; but this distance must be multiplied by the actual length of the plate—and in reality the time taken for the exposure is reduced to approximately 1/10 second during which time the plane has traveled approximately 16 feet. All of which is to say that the picture is taken from two viewpoints 16 feet apart at its ends. This causes distortion which makes

accurate joining of pictures extremely difficult and often times impossible.

The new camera is equipped with the automatic interval device for timing exposures according to the speed of the aeroplane and the automatic spacing device for conserving the film, or in other words, getting more exposures on one roll of film. These also are recent Fairchild inventions which make the true vertical photograph possible. With the perfection of his gyrostabilizer which permits the aeroplane to swing at an angle while the camera remains stationary and insensible to the vibration of wind and motor, the inventor feels confident that photographs can be taken in the absolute vertical, thereby affording a base line from which all other angles may be computed. The vibration of the motor and the wind puffs from the propeller as it whirs at terrific speed, sending some 2,400 wind puffs back every minute when the plane is making 90 miles an hour, are serious handicaps to a camera which is not balanced correctly and safeguarded from these disturbances.

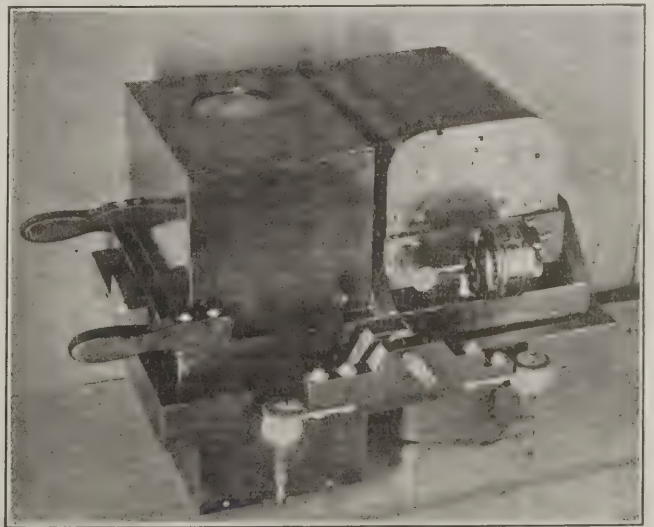
Actual uses to which the new Fairchild camera has already been put would seem to illustrate the soundness and practicability of the inventor's conclusions. Take the aerial photographs of the Carpentier-Dempsey fight in Jersey City for example. Fairchild photographers experimenting with the camera remained at an altitude of 2,000 feet, thereby obeying the law. The weather was anything but propitious for photography. It rained at intervals, mist shrouded the earth and blotted out all details to the human eye. But the eye of the camera nearly a half mile up there over the great arena caught the complete details, despite the law regarding low flying over the crowd, the rain, weak light, haze and heavy mist.

The aerial photographers operating the Fairchild camera photographed the preliminaries of the championship fight, took them back to Manhattan in their flying boat, landed, hurried into a newspaper office where the films were developed and the prints were actually mailed to all newspapers throughout the country before the bout had been decided. After delivering their negatives, the camera men again flew back over the arena in Jersey City and snapped the big fight from the air, remaining until the crowd started to leave. Again they crossed the Hudson River and taking the plates to the newspaper office succeeded in developing them into prints before the arrival of the photographers who had covered the fight from the ringside. It was an illustration of the speed of the aeroplane and the practical and speedy efficiency of the Fairchild camera and auxiliary apparatus.

Then there is the case of the old frigate, *Granite State*, which burned to the water and sank at her dock at 98th Street and North River. The origin of the fire was a mystery until officials scanning the aerial photographs made of the fire and immediately preceding it, discovered the presence of foreign substance floating on the surface of the water along that part of the waterfront. It proved to be oil. An investigation resulted in tracing the oil to a broken pipe line on the river bottom. No factory or plant using the waterways for illegal sewerage purposes can avoid the eye of the aerial camera. It has demonstrated its efficiency in scores of cases; and has been accepted by the courts as material and relevant evidence.

There are recorded cases where companies have been able to influence the award of more than the customary amount of insurance after a fire, flood or other property damage, chiefly because the presented aerial photographs proving the extent of the damage sustained, back of the fire lines, as well as the actual damage done to buildings. It happened in the case of the Erie Railroad pier fire in Jersey City. The piers burned. The damage to them was easily shown and proved by the railroad company. But when they made aerial views showing the paralyzed state of traffic in their yards and on all their trackage, it was not difficult to convince the insurance adjusters that material damage amounted to more than the burning of the piers. It is this same "show me" spirit that has led the owners of large resorts to place in their literature beautiful aerial views of not only their houses or hotels but their surroundings, showing availability and proximity to transport lines and natural scenery.

(To be concluded)



Fairchild Aerial Camera mounted with a gyro. The camera itself is equipped with a between the lens shutter and has an electrical driving unit connected with equal spacing and automatic interval devices. This camera was used for mapping New York City, equipped with 75 feet of film, which permits 116 exposures

RESEARCH FROM THE DESIGNERS', CONSTRUCTORS' AND USERS' POINTS OF VIEW

By MAJOR FRED M. GREEN, O.B.E., M.I.C.E., F.R.Ae.S.

THE development and use of aeroplanes has been of such rapid growth that we cannot but feel that there are possibilities of improvement in everything connected with aeronautics. It is easy to make suggestions for research in every direction and to state a list of questions that would involve many years of work using all our existing facilities. In the hope of making this paper of some immediate value, I propose to confine myself to suggesting lines of research from which an immediate and substantial return may be expected. Research of this type is not always of fundamental importance to the science of aeronautics. I wish to say that I am definitely not in favor of abandoning the more abstract research or, indeed, of relegating it to a second place in our programme, for in the long run it will probably yield results of infinitely greater importance than are likely to be the outcome of the special investigations I shall suggest; but from the designers', constructors' and users' points of view, it is in research of the latter type that the chief interest lies. It is difficult to separate research into such distinct headings as is suggested by the title of the paper. The designer, if he is to be successful, must certainly see things from the users' point of view and also understand methods of construction that will be used in his design. All sorts of research are therefore of interest to him.

Research from the Designers' Point of View.

Before suggesting what lines of research are likely to yield the greatest advantage to the designer, it will be as well to try to put ourselves into his state of mind when he has to originate a design. By this means we shall be enabled to see what are the governing factors in producing the design and to gain some idea of their relative importance.

We will imagine that we wish to produce an aeroplane as suitable as we can make it for a definite purpose. We shall in all probability start by knowing the load to be carried and the density of that load. The maximum distance in a single flight will be known and the climate and geographical conditions in which the aeroplane is to be worked will be stated. The speed at which the aeroplane is to be flown is generally the maximum that can be obtained while satisfying other conditions; in any case, there is a minimum speed below which the aeroplane will be of little use. With the data given, the problem is to design the safest and most economical aeroplane that we can. Economy and safety may appear to be antagonistic requirements, but I think it will be found that without a reasonable degree of safety, economy in operation is impossible.

The requirements being known, the first step is to make a rough estimate of the total loaded weight of the aeroplane, which the designer will do from previous experience. He will also know roughly the maximum load per square foot of plane surface that is permissible, and by this means he will be able to fix the area of the planes and the general dimensions of the aeroplane.

The next step is to estimate the amount of engine power required. The answer to this question will possibly be some horsepower for which there is no suitable engine. The designer must consider the available engines, choose the most suitable and re-estimate the total weight. This can now be done with a fair degree of accuracy, as the weight of the power plant and useful load will be more than two-thirds of the total weight of the loaded aeroplane and the probable error on the weight of the structure of the aeroplane itself should not be a large proportion of the whole.

The designer is now in a position to know what sort of an aeroplane is produced by the original specification and it is more than likely that the resulting aeroplane will be commercially impossible. It may be much too big and expensive for the load it carries or the fuel consumption may be too high. If this is so, the original specification must be amended by reducing the speed or by decreasing the maximum distance to be flown in a single flight. The aeroplane must then be re-estimated to try to reduce it to the least possible cost and size for the work which it has to do.

Immediate Problems Involved

Wing Surface.

From many points of view it is an advantage to use the least amount of wing surface that will give the results required. Smaller wings mean lower first cost, less weight, and less upkeep.

The load per square foot which governs the size of the

wings is generally fixed by the designer's idea of the highest speed at which he thinks landings can be safely made. To some extent also it is governed by the length of time that the aeroplane will take in getting clear of the ground. The designer, therefore, wants information as to the characteristics of various wing sections and also of various shapes and arrangements of planes and is at once face to face with the question of how to apply wind channel results on models to full size aeroplanes. He does not question the accuracy of the work carried out in the wind channels of the National Physical Laboratory and elsewhere, but he must decide whether it is possible to apply them to full scale machines and if so, how to do it.

It seems to me that this is the burning question of the day, and that until designers can be shown how to use wind channel results on wings and until they can be convinced that the results can be used without the chance of serious error, it is of little use suggesting further wind channel research on new kinds of wings. It will be better to devote all the available energy and talent to clearing up this problem than to amass results the value of which is unknown. The present state of uncertainty is bad from another point of view, as it encourages an expenditure of money on experiments unlikely to be profitable. Until it has been clearly shown how to interpret wind channel results, it is unwise to spend much time and money making aeroplanes with unusual wings based solely on these results. It must not be forgotten that the certified test of the National Physical Laboratory carries a great deal of weight, and although no guarantee is given that the results can be applied directly to full scale work, the general public is apt to think that some such guarantee is implied.

A great deal of full scale work has been done in testing aeroplanes at the Royal Aircraft Establishment and at the Royal Air Force Experimental Stations at Martlesham Heath and elsewhere. Unfortunately these tests cannot by their very nature be as clear cut as wind channel tests nor have the results the same kind of accuracy. A large number of corrections and allowances for various disturbing factors have to be made. The expense also of the work is very high. At the same time, the results obtained really do apply to wings of a scale in which we are interested and the figures inspire in the designer more confidence than do wind channel results, which he does not know how to interpret.

For many years experiments have been made with a view to obtaining the resistance of the aeroplane by measuring the thrust or pull of the airscrew. Considerable difficulties were at first found in getting accurate results. It will be of great value if this work is continued, and if full scale tests on the same aeroplane fitted with different sorts of wings can be made and the results published as soon as possible after they are obtained. The results can be checked by making gliding experiments, although the thrust-meter method is likely to prove the more useful. The aeroplane used for this purpose need not be large or expensive and it certainly seems that every effort should be made to establish a connection between full scale and model results for some typical aerofoil such as R. A. F. 15.

Another question in which the designer is concerned in fixing the size of the wings is how much of the maximum available lift the pilot will be able to use; that is to say, at how near the minimum speed will he be able to fly without risk of losing control. Research work on control at low speeds is certainly needed; part of this, I think, can well be carried out in the wind channel in close co-operation with full scale experiments. The cause of the most usual form of flying accident, generally known as a spin, is bound up in this question and it seems not unlikely that one of the greatest dangers of flight may be removed when we have more knowledge of the subject.

Wind channel experiments are valuable chiefly in indicating lines of research, and in providing generalized data with the aid of which suggestions for improving control may be worked out on paper. But until the vital question of how to apply their results with reasonable certainty to full scale aeroplanes is cleared up, I think it is essential that full scale experiments should be carried on with all resources. The size of the controlling surfaces, namely the elevator, tail plane, and wing flaps are all affected by the characteristics of the planes, but again we must know the relation between model and full scale in such matters as the travel of the center of pressure before we can use model results with certainty.

Power Required.

In estimating the power required for an aeroplane it is necessary to add to the drag of the wings the resistance of the body, struts, wires, landing gear, and other parts external to the wings. This is work which can well be done in the wind channel and there is every reason to believe that the results of such work can be applied to full scale work without much error. The measurement of resistance is more a matter of direct experiment than of research. Already a sufficient number of results exist to make a rough estimate possible by analogy with some previous aeroplane, but it is always advisable to experiment on a model of any aeroplane of a new design.

Knowing the total resistance of the aeroplane, the power required can be settled when we know the efficiency of the propeller. This is a matter on which research is needed, particularly on the efficiency of the propeller in relation to an aeroplane body. This seems to be an excellent example for comparing wind channel results with the full scale results, better than can be obtained by the use of a thrustmeter on an actual aeroplane.

Another matter which affects the resistance of an aeroplane is the power used in cooling the engine. We are still uncertain whether it takes more power to cool an air or water-cooled engine and in the case of radiators we are quite at variance as to their most economical arrangement. Research is needed in this matter and it should probably be carried out in connection with the efficiency of propellers mounted in suitable bodies.

Materials for Aeroplanes.

The aeroplane designer is obviously interested in the properties of the materials he uses. The weight of the aeroplane must depend to a large extent on the specific strength of the materials used. A good deal of work has been done on the characteristics of wood, and as this material is subject to such wide natural variations it does not seem that further research will be of much help. So long as wood is used, the making of good aeroplanes will be a matter of art rather than science.

In the covering for aeroplane wings, nothing has yet been produced to compete seriously with linen or cotton fabric treated with suitable dope and protective covering. It certainly would be an advantage if this could be replaced by metallic covering, but such covering must not be of greater weight per square foot and must have reasonable resistance to tearing. Up to the present no such material has been produced. It seems to be more hopeful to spend time on improving the existing fabric dopes in order to make the covering as permanent as possible than to experiment on metallic covering.

Metal Construction.

Up to the present nearly all aeroplanes have been made principally of wood, and the technique of construction of this sort has been brought to so high a standard that it is unlikely that we shall be able to make wooden aeroplanes appreciably lighter than they are now made. The substitution of metal for wood may enable us to effect improvements. Using steel of 45 tons per square inch tensile strength it is possible to make aeroplane structures of at least no greater weight than those of wood. The use of steels of higher tensile strength should enable us to make them lighter. The present difficulty is that in order to make parts suitable for aeroplanes, the thickness of the material has to be small, and we have yet to find out the best methods of making and using thin sheet materials. Many of the fundamental principles have been established and the development of this sort of work calls for research of rather a practical nature.

The use of aluminum alloys for aeroplanes has not made much progress, as there is certainly a feeling amongst engineers that aluminum alloys are unreliable and the use of this material is discouraged by the Air Ministry. The possibilities are considerable but probably a large amount of research work must be done before the extended use of these alloys is possible.

Calculations of Stresses.

Intimately bound up with the use of materials is the knowledge of the stresses at which they can be worked. The more complete is our knowledge of the loading, the lighter we can make the aeroplane structure for a given strength. It has been customary to apply the results of model tests to full scale wings in order to find out how the planes are loaded in the various conditions of flight. We know that this is not strictly correct and that the centre of pressure is generally further forward on the full scale than on the model. More exact knowledge of this subject would enable us to proportion the structure of the wings in a more economical way.

The method of calculating the stresses in an aeroplane structure has been gradually improved. The present methods standardized by the Air Ministry more nearly represent the actual case than those used in most other branches of engineering. At the same time a number of assumptions are made for the purpose of simplifying calculations which are not strictly accurate, particularly in neglecting redundant members. It is generally assumed in the calculations that the incidence bracing takes no load. In actual flight it always does take a share of the load and the result is generally to make the aeroplane somewhat stronger than calculations show. At the same time it is possible that redundant wires may actually weaken the aeroplane and not strengthen it, and research into the method of calculating the strength of aeroplane structures will certainly lead to improvement in design. The calculations may appear at first sight to be so complicated that their meaning will be difficult if not impossible to interpret, but it is probable that more work on this subject will lead to methods which are simpler and easier to understand than the strain energy methods generally in use.

Problems of the Engine Designer.

The success of an aeroplane depends largely upon the performance and reliability of the motor that drives it. The reliability of the motor is to a very large extent bound up with the reliability of the materials that are used in its construction, while the weight per horse power that can be obtained depends upon the stresses to which the materials can be safely worked. The properties of high tensile steels are fairly well known, but engine designers are forced to reckon on a tensile strength far below that which they know can be obtained. As an example, the usual specification for high tensile steel for aeroplane engine parts calls for a tensile strength of 55 tons to the square inch combined with certain other properties. It is well known that steels have been produced which give a strength of 50% in excess of this, combined with the other properties which are necessary and the value of such a steel is obvious. Unfortunately it is not commercially possible to obtain reliable steels of this sort and it certainly seems that research is needed to find out how to produce higher quality alloy steels with regularity.

Aluminum alloys enter largely into the construction of most aeroplane motors, principally in the cast state. Obtaining reliable castings is a difficult matter and we have always to use castings of a weight considerably in excess of what is necessary for strength in order to compensate for their possible defects. We also use an alloy which is at least 10% heavier than we need because the foundries find difficulty in making sound castings of known lighter alloys. The need for research seems to be obvious, but it must be a sort of research that will help to produce the castings required and not merely to make sample test pieces of some particular material. Some of these aluminum alloys are required to maintain their strength when hot and consequently their behavior at temperatures above the normal must be investigated.

The amount of power that a petrol engine can give is frequently limited by the speed at which it can run. This in turn is sometimes limited by the risk of failure of the bearings. Very little indeed is known of the properties of plain bearings under the condition in which they have to work in an aeroplane motor. It is generally considered that the criterion of safety of a bearing is obtained by multiplying the average pressure by the rubbing speed and if the result obtained is lower than a certain figure the bearing will be satisfactory. On the other hand the designers of the Michell bearing assure us that the higher the rubbing speed the higher can be the load per square inch. Here we have two opinions which are diametrically opposed and it certainly needs research in this direction to enable designers to fix their bearing surface with some degree of certainty. The properties of ball and roller bearings also need investigation, as there is much uncertainty amongst designers as to their most suitable form and the loads that can be carried.

Fuels.

The type of fuel that is used in a petrol motor has a considerable effect upon the working of the motor. We know that the addition of benzol to petrol enables us to increase the compression of the engine without fear of detonation, and that other materials can be added to give similar results. Research is needed to determine the most suitable fuel that can be obtained at a commercial price and in commercial quantities.

(To be concluded)

AERONAUTICAL CHAMBER OF COMMERCE OUTLINES FUTURE PLANS

AS we briefly reported last week a meeting of the members of the Aeronautical Chamber of Commerce was held on February 24, when Governors were chosen for the ensuing year.

Samuel S. Bradley presided at the organization meeting as temporary president and in his report to the meeting said in part as follows:

"I think a word of congratulation and appreciation should be expressed as to the very splendid way in which this new organization has been received by the Industry and profession. We have to date 147 applications for membership in the various classes. Since no organized effort was made to solicit members until about the end of last year, I am sure you must recognize that this result is very satisfactory and encouraging.

For the information of those who have recently joined the organization, it may be well, and as briefly as possible, to give at this time a short résumé of the beginning of the movement that has finally developed into the organization of the Aeronautical Chamber of Commerce of America, Inc.

A little over three years ago some of us who had been in contact with the general aeronautical situation realized, that before the Industry could be properly developed and become a well-balanced, positive factor, it would be necessary to provide a properly constituted central trade body. Shortly after that time, the Manufacturers' Aircraft Association, representing a substantial number of manufacturers of planes and motors, in order to encourage the development of a group or common trade interest, developed a comprehensive organization for the collection and dissemination of reliable information relative to the Industry, and established an adequate, well-indexed and up-to-date Aeronautical Library. But those of us having direct charge of this work appreciated, that in order to make it wholly effective and to proceed along the line of least resistance, it would be desirable, if not necessary, ultimately to increase the scope of the organization, by widening its membership. This seemed desirable not only for the purpose of securing increased revenue, but also for the purpose of obtaining a wider diffusion of interest through increased numbers and a greater spread of membership, geographically.

As a result of this conviction a general discussion of the question was held among various representative elements in the Industry to pave the way for a realization of a plan to meet this situation. Articles of Incorporation were secured in the Fall of 1919. At that time, however, and continuing for the next two years, the unsettled state of the Industry, following the cancellation of war contracts and a reorganization of the entire business upon a peace basis, made it impracticable to arouse any real interest in the plan. It was therefore deemed advisable not to attempt to complete the new organization, but to carry on the work that had already been started, holding the situation intact until the Industry had an opportunity to readjust itself to new conditions. Last Fall it seemed that the time had arrived when the subject should be revived. This was somewhat quickened by the fact that it was necessary, in compliance with the law, that the Incorporation be formally

completed and functioning before October 1st, in order to preserve our Charter.

Therefore, the original Incorporators held meetings; formed a temporary organization and authorized the presentation of the plan of the Industry at large. As you know, pursuant to the above, the plan was submitted to about 100 individuals, corporations and firms prominently identified with the Industry, soliciting applications for Founder or Charter Memberships. All of these were tentative in form and were not to become effective until at least thirty applications were received. This gives a clear indication of our modest hopes and expectations. As has already been stated, this presentation of the plan to the Industry was not thoroughly organized and under way until December of last year. We have, therefore, not only great satisfaction, but real assurance, in accomplishing in two months and a half the results already obtained. The fact that in so short a period applications have been received, representing every kind of interest and from the Atlantic to the Pacific, is not only proof that this organization fills a genuine need, but that its plan and scope meet this need as well as the approval and endorsement of the Industry as a whole.

These results in all probability could not have been obtained in so short a time except for the fact that, through efforts of the past, we have had the advantage of visualizing results that may be accomplished in this field. The prestige and experience of the Manufacturers' Aircraft Association in its general activities provided the foundation upon which to build.

Our membership, as you know, comes within three general classifications: (1) Those who manufacture complete units, parts or accessories thereof, or materials or supplies; (2) Those who are engaged in designing or engineering; (3) Those who are engaged in selling, distributing or operating aircraft or who own machines.

The desire of the engineer is to improve aircraft in safety and efficiency.

The desire of the manufacturer is to produce and sell such improved aircraft in increased volume.

The desire of the distributor, operator and owner is to demonstrate the profitable and reliable operation of aircraft.

Proposed Plan of Action

The Aeronautical Chamber of Commerce proposes to aid in the fulfillment of the common desire of all of our Members by "*Selling Aviation*" not only to the American public but to foreign markets, wherever they may be. It proposes to act in three general channels as follows:

- 1—Co-operation with the various Departments and Bureaus of the Government at Washington, having to do with aviation at home and abroad.
- 2—The promotion of Flying Meets, Demonstrations and Aeronautical Shows.
- 3—The holding at intervals, of at least once a year, an Aeronautical Institute, possibly in conjunction with an aeronautical show or flying meet, to be conducted by and for the Engineers and Designers, for the purpose of exchanging thought on scientific development in the art and making such development available for public education.

Indispensable to the successful promotion and prosecution of the above general activities, is publicity, including the Aircraft Year Book. Publicity provides inspiration for effort and capitalizes the results of endeavor. It excites inquiry and satisfies curiosity. It is a distinct and vital function, yet is an integral part of all functions. Upon the constructive and persistent education of the public, through publicity, depends the successful development of our aviation market. It is appalling the tremendous ignorance and misinformation still found, even among educated and generally informed men and women on this subject. As will later be shown, the publicity that has been given aeronautics is beyond our most sanguine hope, but in spite of all that has been printed, done and said, the fact still remains that we have simply scratched the surface. Experience has shown that the press of the country is behind this movement, but it demands continually intelligent guidance.

Recommendations

As a recommendation for continuing the work during the balance of this year, I submit the following:

- 1—Continued co-operation with the various Departments and Bureaus of the Government at Washington, having to do with aviation at home and abroad.
- 2—Steps should be taken at once for the planning and management of a few flying meets, so conducted that they will actually contribute to the maintenance of our organization.
- 3—Arrangements should be made for holding an Aeronautical Institute.
- 4—A plan for the publication and distribution of the 1922 Aircraft Year Book should be perfected.
- 5—A drive for new members should be maintained and actively participated in by each Member.

In reference to the latter recommendation, I think a special word should be added. We recognize that we have met with splendid success in securing members, but with very few exceptions, all of the present membership has been developed by the work of this office. Very little has been contributed through the co-operation of our Members. Before the organization is upon a satisfactory basis, we must have twice as many members as we now have in each class, or its equivalent. The recruiting of new members from now on can be done much more effectively by our Members at large than through this office. In your daily contact you will recognize individuals and firms who should support our organization. If you will send in their applications, you will help and lighten the work tremendously. Every individual, firm or corporation who hopes to make money through the development of aeronautics should be a member.

A meeting of the Board of Governors will be held early in March for the purpose of electing permanent officers, appointing committees and arranging details of the year's activities.

OPERATION OF AEROPLANES OVER FORESTED AREAS

It cost the government last summer \$128,528.28 to operate aeroplanes over the forested areas of the States of California, Oregon and Washington, comprising 150,000 square miles, according to a report submitted by the 9th Corps Area Air Officer. The value of the timber protected in this area is estimated at \$625,000,000, making the cost of protection afforded by the aeroplanes slightly over 2 percent—a very small ratio, especially if the added value of the water sheds and other resources depending upon the forest protection are considered.

Of the total number of 1284 fires reported, 376 were reported by aeroplane before being reported from any other source. The total number of hours flown during the past fire patrol season was 2,777.17, and the mileage covered totalled 260,211.

As far back as 1912 the use of aircraft for forest patrol has been given consideration as a valuable adjunct, on account of its superior mobility and range of observation. In 1919 the first protective flying activities over forested areas was started, and continued during 1920-21. The lessons learned in the previous years were applied during the 1921 season with gratifying results. Last summer the efficiency of the patrol increased noticeably, due to the experience of the observers in reading the topography of the country. Having acted in the same capacity the summer before and flying over the same territory, the observers had come to know the location of every saw mill and lumber camp, and no longer wasted time in trying to determine the source of smoke rising in spots where they knew smoke logically belonged. They knew the areas where men had received permits to burn brush and did not cause confusion at headquarters by reporting these licensed blazes.

A conception of the values involved in forest protection are made apparent from a letter received from Forester H. S. Graves, wherein he states that of the total forested area of the United States, about 550,000,000 acres, approximately 27% is under government ownership and comprises National Forests, National Parks, Indian Reservations, Military Reservations, and unreserved public lands. Lumbering comes next to agriculture among the basic industries of the United States. Its importance is emphasized by the investment of two and one third billion dollars and its employment of over 900,000 men. The estimated value of the timber resources of the United States is more than six billion dollars. Statistics secured for the years 1915-1917, inclusive, indicate that the average damage caused by forest fires annually amounts to approximately ten million dollars. These statistics also show that there are upwards of 28,000 forest fires annually in the United States, and that the average acreage burned over annually is more than eight million acres. The National Forests comprise 150 million acres and contain an estimated stand of timber of six million feet, board measure. A conception of this figure may be had in a measure when it is realized that the average annual cut in timber throughout the United States amounts to forty billion feet.

The operation of the aeroplane patrol during the past season was considerably handicapped. Due to a deficiency in Quar-

termaster appropriations, there was a shortage of gasoline and oil, rendering it necessary to temporarily suspend the patrol activities altogether during a period of the greatest fire hazard of the entire season. Inadequate personnel, resulting from the general reduction of the Army and the lack of transportation funds made it impracticable to conduct the patrol to the extent planned, and even under existing conditions the personnel available were worked to the limit to continue the patrol. These difficulties were partly offset by the support and cooperation of the Forestry officials, States and municipalities. The States of Oregon and Washington both appropriated funds for the purchase of gasoline and oil, and it is estimated that the people of these two States spent approximately \$75,000 in the preparation of landing fields, of which Oregon has, exclusive of small emergency fields, 10, and Washington 7. The number of fields in California totals 33. The Chamber of Commerce of Corning, Calif., provided a field and erected barracks at a cost of about \$2,000. Alturas and Montague, Calif., furnished landing fields. An emergency field was prepared at Orleans in the Klamath Forest, also at Gravelly Valley in the California Forest and Fresno Flats in the Sierras.

The Forestry Service expended last year in connection with the forest patrol for salaries, landing fields, radio, telephones, etc., \$19,450, to which must be added the purchase of 26,000 gallons of aviation gasoline for \$7,670, and the payment of approximately \$1,800 for freight charges on same, making a total expenditure of approximately \$28,920.

The patrol as put into effect covered the principal forests of California, Oregon and Washington, with bases at Eugene and Medford, Oregon; Camp Lewis, Washington; Mather Field, Visalia, Corning and March Field, California.

An elaborate radio system was used with stations at all bases and important points, so that reports sent from aeroplanes could be checked up without delay and transmitted promptly to proper authority. Daily patrols were carried out regularly as far as weather conditions and supplies permitted, and special patrols were sent out as demanded by special fire hazards due to electrical storms, opening of the deer season, etc.

The Army Air Service utilized two squadrons on this patrol, the 9th and the 91st, comprising a total of 26 officers, 24 flying cadets and 466 enlisted men. There were a total of 25 aeroplane crashes during the season, resulting in four fatalities.

The following tabulation, showing losses sustained as the result of forest fires from 1917 to 1920, inclusive, forcibly demonstrates the fire hazard in the forested areas and the urgent need of adequate fire patrol measures:

CALIFORNIA		
Year	Acres Burned	Loss
1917	336,948	\$183,477.00
1918	170,275	68,943.00
1919*	207,433	97,043.00
1920	129,798	155,589.00

*Aerial forest fire patrol was begun in 1919.

WASHINGTON

Year	Acres Burned	Loss
1917	Not available	
1918	Not given	\$473,054.00
1919*	Not given	478,670.00
1920	Not given	336,172.00

*Aerial forest fire patrol was begun in 1919.

OREGON

Year	Acres Burned	Loss
1917	Not available	
1918	Not given	\$893,077.00
1919*	Not given	478,670.00
1920	Not given	121,800.00

*Aerial forest fire patrol was begun in 1919.

The advertising value of the forest patrol must also be included. The presence of the planes without doubt impressed the people with the efforts that were being made to prevent forest fires and also made them more careful to avoid starting fires. The use of aircraft in actual fighting of forest fires was of special value in that a complete survey could be made of the fire and plans drawn up to best accomplish its control. The element of time in forest fire patrol must be given great weight in cases such as immediately following an electrical storm in which the aeroplane shows its value in being able to cover in a short time a large area and check up all incipient fires.

In the operation of the patrol of the Coronado National Forest in Arizona, the estimated cost of same for the fiscal year 1922 is given as \$3,010; hours flown 148½; number of fires discovered and accurately located, 7; and the cost in excess of normal flying \$1,647.96.

A larger forest fire patrol project for next season has been worked out in detail and carefully considered, both by the Air Service and Forestry officials. This project contemplates an additional base at Missoula, Mont., and sub-bases at Spokane, Washington; LaGrande, Oregon; Boise, Idaho; Cody, Wyoming; and Helena, Montana. This extension would include a patrol of the principal forested areas of the States of Wyoming, Montana and Idaho. The project involves the utilization of 5 squadrons, 160 officers, 660 enlisted men and 90 aeroplanes, at a total cost of \$2,641,790.

The report goes on to say that there is apparently no effort being made at the present time on the part of any Governmental department to push the matter of forest patrol for the coming season. The Forestry Bureau has stated that under existing conditions they do not contemplate the use of aircraft but will confine their efforts and funds to ground observation. The Interior Department plans do not involve use of aircraft in protection of forested areas for which they are responsible. With present funds, equipment and personnel it is impracticable for the Air Service to carry on forest patrol without discontinuance of proper Air Service functions. Any decided pressure brought to bear for an aerial forest patrol will probably come from the private interests of the Northwest, California being excluded, for the reason that the great majority of timber lands in that State is government and not privately owned.

AERIAL TRANSPORT TODAY AND TOMORROW

By Lt. Col. W. A. BRISTOW, M. I. E. E., F. R. Ae. S.

(Continued from page 627)

On many occasions machines have had to leave this side only very scantily informed of the weather conditions existing over long stretches of the route in France and in some cases with no information except some several hours old. As a result passengers have been landed in all sorts of out of the way places. It is considered by the author that the safest policy is not to send passengers off unless and until complete reports are available showing a safe route for navigation along its entire length, but this obvious desideratum cannot of course be obtained unless the meteorological and wireless departments on both sides of the Channel are working at 100% efficiency.

Greater apparent safety.

At present aeroplanes often do not look and sound as safe as they actually are. Many in this audience are thoroughly familiar with the noise of aeroplane engines but the average man in the street taking to the air for the first time is often rendered extremely nervous by the unmuffled roar from engines giving hundreds of horsepower. Most passengers complain of deafness after a flight and also of not being able to talk, except with the greatest difficulty, when en route. Further the noise adversely affects the safety of the machine by reason of the fact that it prevents the pilot hearing any unusual noise in his engine and also prevents him making full use of the wireless telephone. There are at least two proved types of efficient silencer available, which are easy to fit and low in cost and it is hoped that this year may witness their general adoption. In some machines also there is an excessive amount of vibration that is very disconcerting and which should be eliminated.

Pilots should as far as possible avoid any sudden alteration in position of the machine and should also abstain from unnecessarily sharp turns involving undue banking. Suddenly shutting off the engine and gliding down en route in order to look at, for example, a machine on the ground has been known to have an alarming effect on the uninstructed passengers and manœuvres of this character should be avoided, but if unavoidable they should be carried out as gradually as possible. A careful and considerate pilot can do much towards establishing the confidence of his passengers.

Many of them also do not like being seated in or near the line of the propellers in twin engined machines. It may be quite alright but it does not look safe, and many passengers also do not feel safe when sitting facing the tail of the machine. It is considered that every effort should be made to sit all the passengers facing forward with sufficient leg room, comfortable chairs and a clear outlook. It is fairly obvious that a comfortable, well-stowed passenger must feel infinitely safer than one sitting facing backwards on the edge of a small seat, with a view comprising only two propellers whirling within a few feet of his head.

Comfort.

In addition to the problem of increasing the safety and the apparent safety of flight there is the added difficulty of providing a machine that can favorably compare with other forms of transport in the matter of comfort. Most passenger cabins are either too hot or too cold and there does not appear to have been any serious endeavor to arrange for a sufficiency of fresh air without draughts. In some machines there is also a strong smell of hot oil which can have most unpleasant effects.

Lieut Colonel C. B. Heald, C.B.E., Medical Adviser, and Wing Commander Beatty, C.B.E., A.F.C., Deputy Controller, Department of Civil Aviation, Air Ministry, have carried out some very valuable experimental work in connection with the ventilation of aircraft and with the data now available there is little excuse for the continuance of the discomfort and illness that has been caused in the past through inattention to these important questions. In machines fitted with water-cooled engines it should be a comparatively simple matter to fit specially light hot water radiators in the cabins in parallel with the main engine cooling circuit, and with air cooled engines a portion of the cooling air flow, not the exhaust, could be passed through light tubes.

Travelling to Paris a few weeks ago, the temperature in the machine was 32°F. for over two hours, in addition to which there were a few draughts of about 500 feet per minute. After standing about at Le Bourget for ten minutes in a biting east wind and driving to Paris, the whole of the passengers had had enough and several went back by train for the sole reason that it was too cold to go by air. In this particular case, as in many others, the journey was made in the middle of the day and

most of the passengers had no food between breakfast and four o'clock in the afternoon. It would be an easy matter to provide small cardboard boxes containing a little food and drink especially at Croydon where there is an hotel on the Aerodrome.

Luggage.

The difficulties in dealing with passengers' luggage have also to be surmounted before the travelling public can be diverted from the railways in the necessary numbers. In the past about 30 pounds weight has been allowed for free luggage, but as can easily be seen by watching the departure of the boat trains there are only a relatively small proportion of passengers whose luggage does not exceed this weight. In many cases it has been possible to take excess luggage on the aircraft, but this is a very expensive luxury. In some cases passengers' luggage has been put on other machines which have been forced to land on the way, sometimes the companies have sent it by a special courier by rail, but these expedients cannot be continued indefinitely.

There is also the difficulty with regard to the size of the packages that can be taken. There is sometimes plenty of room in the fuselage but the doorway is too small. All these things may seem very trivial to the makers of the machines but the inconvenience caused to the public and the operating companies is enormous. There was a pathetic tragedy at Croydon recently—a charming French bride in tears because all her hats had been left in Paris owing to the aeroplane doorway being three inches too small to allow the hat box to enter. This unfortunate lady, it is said actually remained in her room at the Savoy for three days waiting for the box to arrive!

The author is of the opinion that the maximum weight of free luggage allowable must be raised, that the charge for excess luggage must be reduced and that companies shall not part a traveller from his baggage.

Landings en route.

Another serious source of inconvenience to passengers is the delay that arises if they should be unfortunately landed anywhere else but at an aerodrome at which a Customs officer is stationed.

First the pilot must find a constable who on arrival in effect arrests all the passengers and conveys them to the nearest police station, perhaps several miles away. Here they are put through their paces by the Superintendent who then retires to consult his numerous notices and regulations in order to see the next move. He then proceeds to impound all the passports and send for the nearest Customs officer, which may involve a hunt through all the hotels for miles around. After he has been found and has conducted his examination, passengers are free to proceed to the nearest main line and catch a train, if there is one left, but without their passports which remain at the police station from whence they are sent to some authority in London. Incidents of this nature are bound to result in loss of business. Of course the moral is obvious—don't come down on the way—but the weather and other factors are not yet sufficiently subdued to enable this excellent rule to be always observed.

This actual case is recommended to the notice of the authorities in the hope that something can be done to reduce the delay and inconvenience that so often accompanies what is obviously and perfectly bona-fide forced landing of a well known machine and pilot. Whilst there is to-day perhaps some little excuse for occasionally landing passengers at places other than their destination, yet it is certain that a continuance of this practice is bound to prejudice most seriously the future of the business.

The remedy is in the hands of many. Firstly, it is essential that we procure international co-operation with a view to improving the system of reporting the weather en route. It ought to be made impossible for pilots to have to land at all sorts of out-of-the-way places because of unforeseen weather conditions, and if bad weather comes up suddenly they should be warned by wireless in time to enable them to retrace their steps to the nearest aerodrome.

Designers also should sit down deliberately to design a bad weather aeroplane in which the probability of arrival at the proper destination is as great as in the case of, let us say, an Atlantic liner. Much improvement could be made if the principle involve were adopted. In such a machine, for example, amongst other important features great care would be devoted to the

position of the compass and the wireless equipment, as a full and proper use of these has a most important bearing on the subject. Too often they have been regarded as of only minor importance and the various units have been squeezed in after construction in the most unsatisfactory manner and in which their potential usefulness has been reduced to almost negligible proportions.

Further, the operating companies themselves are divided into two distinct camps. There are those who consider that the public must have reliability and that this means reliability of departure; the other school of thought believes that reliability involves reliability of arrival, even though it may involve gaps in the programme of start. Some booking agencies prefer the first method as if the machine starts, their commission on the tickets is assured, and transport companies who adopt this policy may therefore procure a larger percentage of the passengers booked at agencies if they acquire the reputation of being certain starters no matter what happens afterwards. It will probably be found, however, that the business as a whole will best be encouraged by adopting the alternative policy, as a very considerable risk and inconvenience is involved in departing in really bad weather when there is only a small chance of getting through.

Cost of Travelling by Air.

The old price for a ticket to Paris was £10 and when the fare was reduced to £6 the number of passengers increased very considerably; whether this increase was entirely due to the lowering of the fare we have no means of knowing but it seems fairly safe to assume that it was so to a fairly considerable extent.

The question that naturally arises is, can the required volume of traffic be obtained whilst the fare is so much higher than that charged by train and boat? The standard reply is the difference between the first class fare and the price charged is only small, but is this a fair way of looking at the question? Considering that much of the aeroplane accommodation has been only fourth class (and that flatters some machines) it would appear to be a wrong basis for comparison especially if the point be conceded that quite a number of people like to travel comfortably as well as quickly. Although I have never heard it referred to in aeronautical circles, yet it is believed that there are even second class passengers on the boats and trains.

If the companies believe they will obtain their full volume of passengers from the rich, there is nothing more to be said, but if it is agreed that an aggregate of two or three thousand passengers weekly are required then it seems inevitable that the fare will have to be adjusted to meet competition, and the hitherto despised second class passenger will have to be catered for. A traveller who pays usually second class fare may be willing to pay 70% above the first class fare once for the sake of the experience, but he almost certainly will not continue to pay a sum that is well over thrice the cost of his normal method of travelling.

Very few people seem to know that a return ticket to Paris can be procured for less than £3. The author is of opinion that the single fare from London to Paris by air will have to be reduced to £4 before the necessary increase of passengers can be obtained. The time may not be ripe for this reduction as it is doubtful if the British machines available this summer will be sufficient to deal with a very large increase of passengers but is considered that at least by 1923 the question will have to be very seriously considered.

Educational.

In the foregoing notes it has been assumed that there are already a sufficient number of people willing to travel by air providing it is made perfectly obvious to them that their safety and comfort are assured. This assumption may however be incorrect and it is possible that if the views of the bulk of the cross-Channel travellers were taken it would found that in the great majority of cases they would refuse to travel by air in any circumstances whatever. It may be therefore that at present there would not be sufficient passengers even if the fares were the same, and if this be the case some form of general educational propaganda is a vital necessity if the needs of the future are to be met.

In any case it is probably a necessity, and if the tube railways of London still find it necessary to spend large sums yearly in order to attract more passengers to the underground system of travel, how much more essential must it be to undertake a similar campaign in respect of travelling at about three thousand feet over ground and without any visible means of support?

A whole paper could be written on this subject but a few words will suffice to give some idea of what such a policy of education and propaganda might entail.

(a) The history of flying, the development of commercial

aerial transport and the engineering and scientific aspect of flight should be part of the curriculum in every school in the country so that the rising generation may be taught to regard air travel not as a romantic novelty but as one of the sober facts of life.

(b) The cinema should be much more extensively employed for the purpose of keeping the public informed of the possibilities of air travel.

(c) The press, who already carry on such excellent work, could render it even more valuable by publishing statistics as to the high standard of safety and reliability already attained and occasionally affording some of their space to the rather more practical side of commercial aviation. Quite a number of people who read only one or two papers are still under the impression that commercial aviation is carried on by "huge flying projectiles" which are loaded up with passengers and shot to their destinations at incredible speeds, and they naturally recoil from the idea of travelling in this manner.

(d) Joy-riding concerns should be encouraged as much as possible and approved firms might even be given a small subsidy in some form or other.

There are other means which are also fairly obvious, but the carrying out of such a programme can only be rendered possible by the co-operation of the various interests.

The author suggests that this is eminently a case for the consideration of the Society of British Aircraft Constructors who might form a small committee including representatives of other interested bodies, the object of which would be to devise and actually carry into effect some sort of general educational work.

Life Assurance Policies.

Last, but by no means least, assurance companies should be persuaded to allow ordinary flying under the terms of their standard life and accident policies. Is it likely that people who have paid premiums for years are going to travel by a route on which their policies would be null and void in the event of their death, especially if they have real dependants. Further, it is a very bad advertisement for civil aviation when almost every life and accident policy in the country places a complete ban on flying. The general removal of this restriction will mark a red-letter day in the history of flying and it will become certainly an important, if not the most important date in civil aviation and no effort should be spared in endeavoring to procure this vitally necessary reform.

Conclusion.

This Conference comes at a most critical period alike for the country and for commercial aviation. In view of the vital importance of commercial aviation and its relation to air power it is lamentable in the extreme that in this year, the fourth after the Great War, the British Commercial Air Fleet should consist all told of less than twenty aeroplanes; in fact on the day this was written there were only six or seven. It is especially serious from a national standpoint because our future depends to a very large extent upon our being able to bring the various parts of the Empire into closer relationship.

The British Empire embraces close upon 13 million square miles of territory and has a population of 440 millions. In the development of the various parts of the Empire and in the interlocking of the whole the question of transport and communication is of fundamental importance, and it is greatly to be regretted that the public here are not more fully aware of the importance with which the matter is regarded in other parts of the Dominions.

For example, take Canada,—the latest Canadian Air Board report clearly indicates that much of the work in connection with the development and protection of the country is being completely revolutionized by the use of aircraft and that every day aircraft are engaged in forestry reconnaissance, photography, fire prevention, exploration, communication, transportation and for many other purposes with the most remarkable results.

History shows the vast importance of transport and how that the manner in which its problems have been dealt with has been a cardinal factor in the making of nations. The greatness of the Roman Empire was to a very large extent achieved through its wonderful system of roads which incidentally were built by the government regardless of expense, and the remarkable development of the United States is undoubtedly due to an extraordinarily well developed and efficient railway system.

The United States with one-fifth the population of the British Empire and of less than a quarter of the area has a railway mileage of 251,984 as against the 134,131 miles in the British Empire. Not only that, but the narrowness of our tunnels and the weakness of our bridges so hampers the de-

velopment of our locomotives and rolling stock that we are compelled to operate on a very low level of efficiency with the result that to-day we see trades being forced on to the roads in their frantic endeavors to save their business from disaster. The neglect of another means of transport in our waterways costs this country millions of pounds yearly.

Is the history of British Commercial Aviation to proceed along these dismal lines? Are we to see French and German machines all over Europe and running as far out as our interests in the East? Are we going to take a short-sighted view of the technical needs of the situation as the railways have done, so that we are handicapped from the very start?

In these notes stress has been laid upon the fact that commercial aviation should be able to stand by itself financially, and there is no doubt that if we can make it so our chances of supremacy will be improved, but profit or no profit, other countries are not going to allow the business to fade away. The London-Paris service has been of the greatest value in showing us what to do and what not to do, but the situation urgently demands that we ask ourselves to-day—what is our real programme and what is the next step? Are we prepared to face the opening of 1923 with a total fleet of about twenty machines or one for each 600,000 square miles in the Empire?

The position is serious in the extreme and what should be a big concerted national effort is left to a small group of enthusiasts in the Air Ministry and in the industry.

What we want are firstly funds and a revised policy for research and experiment in connection with the problems associated with the development of civil aviation, and as a temporary measure we want a large number of engine and machines ordered to-morrow of the very latest types.

We also require an establishment for the training or re-training of commercial pilots and such training must be of a far more comprehensive character than it was possible to give during the war. Our present position with about a dozen first-class pilots in training is almost ridiculous, especially when we consider that four years ago we had about 20,000 pilots, and 35,000 engines were turned over to the Disposal Board.

For months past we have been giving unemployment pay to thousands of skilled workers in the late aircraft industry. Is

it impossible to put these men to work on manufacturing machines and engines? I am told that in many grades there is little difference between employment and unemployment pay and if this is true it seems absurd to keep on paying away hundreds of thousands of pounds to idle men whilst an industry that is vital to our very existence as a first-class power is allowed for want of orders to languish to the point of extinction.

As business men we do not need reminding that it is imperative that the national expenditure be reduced, but being business men, we also know that much of the money that has been spent since the war could have been most advantageously expended in other directions and that a small portion only would have enabled the aircraft industry to be kept alive and civil aviation to be placed upon a much broader and more efficient basis.

During the war we utilized our materials to the fullest advantage by establishing a system of priority. Money is the raw material of peace, and if we are to husband our resources and yet achieve the maximum possible progress we must have a properly thought out system of priority in expenditure. At present, incredible as it may appear, there is no such system.

This is a most critical time. We have it in our hands to make or mar the future, and posterity will judge us accordingly. We can succeed if only the nation will take the trouble to envisage intelligently the real position and then go steadily ahead with all the powers of determination, energy and self-sacrifice that we have exhibited in other directions.

It is the duty of the Government, the Air Ministry and the aircraft industry mutually to co-operate with goodwill on a bold and militant policy that will secure for the country and the Empire the great and material benefits that most surely will follow upon the establishment of a British aerial transport industry on a wide and sound basis. Neglect of this opportunity will involve us in consequences of the most disastrous description, and although we cannot pretend to see the full measure of the cost we at least can see that our position in Europe and the integrity of the Empire would be most gravely imperiled.

(To be concluded)

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, January 1922

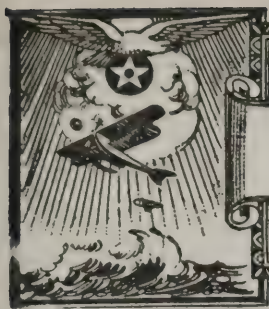
DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST					
														Gallons of Gasoline	Total Time Run	Hr., Min.	Total Miles Run	Cost per Hour	Cost per Mile
EASTERN New York- Chicago.....	\$3,419.82	\$667.50	*	\$3,434.26	\$1,090.36	\$1,204.10	\$3,286.46	\$1,543.26	\$4,059.31	\$4,077.83	\$2,344.02	\$834.39	\$40,755.97	10,935	380 08	36,543	\$107.25	\$1.12	
CENTRAL Chicago- Rock Springs	4,364.76	1,065.27	4,146.38	3,179.58	1,075.70	819.75	3,359.79	2,235.07	5,553.97	5,074.78	3,394.78	1,208.42	35,478.25	15,850	625 47	57,551	56.67	.62	
WESTERN Rock Springs- San Francisco	3,568.08	652.75	**	2,016.96	1,026.03	753.65	3,594.18	1,543.26	4,414.25	5,967.07	2,344.02	834.39	40,318.85	11,970	485 27	43,593	83.04	.92	
Totals and Averages.....	\$11,352.66	\$2,385.52	\$32,545.25	\$8,630.80	\$3,192.09	\$2,777.50	\$10,240.43	\$5,321.59	\$14,027.53	\$15,119.68	\$8,082.82	\$2,877.20	\$116,553.07	38,755	1,491 22	137,687	\$78.15	\$0.85	

* Includes new motors in planes Nos. 191, 193, 284, 288 and 289.
** Includes new wings and landing gear on plane No. 107; new wings on plane No. 147; new wings, altimeter and wheels on plane No. 159; new motor in plane No. 221, and overhauled motors and wings on planes Nos. 264 and 265.
Total cost of operation.....\$116,553.07
Permanent improvements.....1,086.98
Grand Total.....\$117,640.05

COST PER MILE			
Division	Overhead	Flying	Maintenance
Eastern.....	\$0.24	\$0.23	\$0.65
Central.....	.18	.19	.25
Western.....	.20	.20	.52
Entire Service.....	.20	.20	.45

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio.
Flying consists of: Gas; Grease and Oil; Pilots.
Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories; Warehouse.

E. R. WHITE, Acting Second Assistant Postmaster General.



NAVAL *and* MILITARY AERONAUTICS



Cross Country Flying in the U. S. Air Service

It is estimated that during the calendar year 1921 a total of 5,063,909 man miles were flown by the Air Service personnel on cross country flights. These figures cover only flights exceeding a distance of ten miles from an airdrome with a definite destination in view, either with the purpose of landing at that destination or returning from the destination upon completion of the specific purpose of the flight without landing away from the airdrome.

By man miles is meant the number of miles flown by each man in any one plane, i. e., a plane carrying two people and traveling to a station 50 miles distant and return will carry out 200 man miles of cross country flight. The tabulation given below shows the number of man miles flown at the various Air Service stations, from which it will be noted that Post Field, Fort Sill, Okla., heads the list with 826,084 man miles. The Commanding Officer of that station states that the total time flown by all pilots at the field—9,836 hours, at 85 miles per hour, total 836,060 miles or, based on two persons in each ship on each flight, the man miles total 1,672,120, approximating a distance equal to 67 times around the world.

Location	Man Miles
Aberdeen Proving Grounds, Md.	80,000
Americus, Ga.	6,700
Bolling Field, Anacostia, D. C.	230,000
Carlstrom Field, Arcadia, Fla.	198,175
Chapman Field, Miami, Fla.	755
Crissy Field, Presidio, San Francisco, Cal.	132,710
Chanute Field, Rantoul, Ill.	85,000
Douglas, Arizona	36,550
Ellington Field, Houston, Texas	125,912
Fort Bliss, Texas	23,410
Fort Riley, Kansas	1,600
Fairfield Air Intermediate Depot, Ohio	30,660
France Field, Panama Canal Zone	43,397
Godman Field, Camp Knox, Ky.	50,510
Kelly Field, San Antonio, Texas	489,904
Luke Field, Hawaii, H. T.	114,705
Love Field, Dallas, Texas	30,963
Langley Field, Hampton, Va.	506,832
March Field, Riverside, Cal.	541,600
Mather Field, Mills, Cal.	807,119
incl. Forestry Patrol	
McCook Field, Dayton, Ohio	290,940
Middletown Air Intermediate Depot, Pa.	3,621
Mitchel Field, Long Island, N. Y.	133,045
Montgomery Air Intermediate Depot, Ala.	62,769
Nogales, Arizona	43,270
Park Field, Millington, Tenn.	2,000
Pope Field, Fayetteville, N. C.	22,405
Post Field, Fort Sill, Okla.	826,084
Rockwell Air Intermediate Depot, San Diego, Cal.	36,096
Ross Field, Arcadia, Cal.	5,580
Free Balloon Flights	
San Antonio Air Intermediate Depot, Texas	29,930
Scott Field, Belleville, Ill.	6,200
Selfridge Field, Mt. Clemens, Mich.	5,710
Vancouver Barracks, Wash.	225
Hqrs. 1st Corps Area	28,900
Hqrs. 3d Corps Area	7,950
Hqrs. 5th Corps Area	13,082
Hqrs. 6th Corps Area	6,000
Hqrs. 7th Corps Area	3,600
Total	5,063,909

It may be safely assumed that the largest majority of these cross country flights were made with two occupants in the plane, but there have been many instances where flights were made in single-seater planes or in other types of planes where the pilot was the only occupant of same. Estimating on a conservative basis that, say, 10 per cent. of the number of cross

country flights were made with the pilot as the sole occupant of the plane, and the remaining 90 per cent. with two occupants in the plane, we would have as the total distance actually traveled by aeroplanes on cross country flights during the calendar year of 2,785,150 miles. This figure, of course, does not represent all flying done in the Air Service during the year, as flights made at the different fields, other than cross country flights, are not included.

Fast Flying Between Washington and Dayton

What is considered a record non-stop flight between Dayton, Ohio, and Washington, D. C., was made by Lieut. C. V. Haynes, Air Service, on Saturday, February 4th, in a special DH-4B Messenger ship, the trip consuming two hours and fifty-five minutes. The distance between Washington and Dayton is 440 miles, making the rate of speed traveled by this plane slightly in excess of 147 miles per hour.

Thomas Morse Monoplane to be Tested

Flight tests of the Thomas Morse Monoplane MB-7 are to be made at Mitchel Field, L. I., New York, in the near future before representatives of the Naval Board of Aeronautics. Lieut. Flier of the Marine Corps has arrived at Mitchel Field to watch the setting up of the ship and the preliminary flights.

We thought that the Army Air Service had the exclusive title to the honor of having an aeroplane pilot with the most appropriate name (Captain A. I. Eagle), but we will have to hand the palm to the Marine Corps, as "Flier" is pretty hard to beat.

What Carlstrom Field Has Accomplished Last Year

The total flying time at Carlstrom Field, Arcadia, Fla., from January 1 to December 31, 1921, was 19,830 hours. From June 1, 1920 to July 15, 1921, a total of 301 students reported to the field for training, 184 graduating and 98 failing to complete the course. During this period there were a total of 6 casualties, or two per cent. of the total number reporting.

New Class for Flight Surgeons at Mitchel Field

A new course for Flight Surgeons was opened at the Medical Research Laboratory, Mitchel Field, L. I., New York, on February 1, 1922. The student personnel, consisting of five medical officers from the Army and five from the Navy, are as follows: Captains Harrison Fisher, Joseph W. Garrett, William D. Middleton, Frank C. Venn and Lieut. Thomas F. Weldon of the U. S. Army, and Lieuts. Julius F. Neuberger, Victor S. Armstrong, Clark Robertson, Page C. Worthington and Louis Iverson of the U. S. Navy.

This is the first class at the School for Flight Surgeons in which the Navy has had student representatives, and followed a request made by the Secretary of the

Navy to the Secretary of War. The course of instruction extends over a period of three months.

19th and 23rd Squadrons Scheduled For Hawaii

The 19th Pursuit Squadron and the 23rd Bombardment Squadron will proceed for duty in the Hawaiian Department some time in April next. Officers accompanying the 19th will be: Major George H. Peabody, Captain F. I. Eglin and 1st Lieuts. E. S. Norby and Raymond Morrison. First Lieutenants Harold Brand and A. B. Ballard will accompany the 23rd Squadron.

Kelly Field Activities

Test flying and GAX instruction has been carried out by the 90th Squadron recently, although the clear weather periods have been but few. New motors are being installed in several ships, which are also being re-rigged while out of commission.

Officers of the 2nd Group (Bombardment) may be given an opportunity in the near future to get away from the steady diet of DH-4B's. Effort is being made to secure a few SE5's, and Spads so that new pilots in the Group may be qualified on all available types.

Lieut.-Colonel John H. Howard, A. S., assumed command of Kelly Field on February 1st, relieving Major John N. Reynolds, A. S., who has been appointed Wing Operations Officer. Colonel Howard comes to Kelly Field from Fort Sill, where he recently completed the course of training for observation pilots.

Student Pilots at Carlstrom Field

The new classes of officers and cadets have recently reported at Carlstrom Field for pilot training. The officer class is very small this time, and only about a dozen have reported to date, while some 75 cadets have reported. About 25% of the cadets are from the enlisted personnel of the Air Service and 75% from civil life. This will probably be the last class to graduate from this station, due to the expected moving of the school to Kelly Field.

Flying Cadets Commissioned in Reserve Corps

Commissions have arrived at Mather Field, Mills, Calif., and orders have been issued covering the discharge of members of the first class of cadets. These men are being discharged to accept commissions in the Officers' Reserve Corps. All express a desire to continue in the service as cadets or as officers, but no provision has been made to answer the desires of capable pilots whose enthusiasm for flying is so self evident.

This class of cadets made the forest fire patrol possible through the season of 1921, the patrol covering the States of Oregon, Washington and California. The work they accomplished speaks for itself. These pilots have had approximately 250 flying hours apiece in the air, and have developed into exceedingly efficient pilots.



FOREIGN NEWS



Commercial Aviation in Great Britain

The British Air Ministry's report for the six months ended September 30, 1921, just received by the Department of Commerce from Consul Reed at London shows that fewer passengers and less tonnage were carried by air in the summer of 1921 than in the two preceding summers. From the standpoint of the number of passengers carried, the period from the inauguration of commercial flying on May 1, 1919, to September 30, 1919, was the most active, although most of these were local flights. In the number of cross-channel passengers carried, the six months period just ended ranks first.

The following table summarizes the performance of British commercial air services for the periods specified:

Period	Total Passengers	Cross-Channel Passengers	Tons of Freight
May-September, 1919	58,132	.....	20.2
October, 1919-March, 1920	9,808	.....	25.8
April-September, 1920	32,345	4,697	86.5
October, 1920-March, 1921	10,103	2,023	38.0
April-September, 1921	31,853	8,531	9.0
Total	142,241	15,251	179.5

During the summer of 1921, passenger traffic reached its height in August, when 9,609 persons were carried, of which 2,021 were cross-channel passengers, mainly residents of Great Britain and France.

Subsidies amounting to £200,000 per year, now paid by the British Government to provide a regular air service between London and Paris will be continued for some months. A permanent scheme of subsidies is contemplated, however, and it is now proposed that the government shall pay to certain approved British firms operating a cross-channel air service with British machines and engines a subsidy of 25 per cent of their gross earnings, and that the Air Ministry shall provide a portion of their air fleet on a hire purchase basis at less than cost price. Besides this, it is proposed to grant an additional £3 per passenger and 3d. per pound of freight for the year ending February 28, 1923, and a contribution of 50 per cent of the cost of insurance, up to 10 per cent of their value, for machines provided by the Air Ministry.

During the past year certain features of air navigation have been more or less standardized. All British machines operating on cross-channel routes are now fitted with wireless apparatus, and under the new Air Navigation order this will be made compulsory for all machines capable of carrying 10 or more passengers. The stations at Croydon and Pulham have been provided with wireless direction finding stations which work together and enable aircraft to ascertain their positions. Experiments are being made with various pyrotechnic devices and colored searchlights for directing aircraft to aerodromes in fogs or mists.

Over the Alps

Zanetti, the Italian pilot, is reported by the Paris correspondent of the London *Daily Mail* as having flown the Alps at an altitude of 30,500 ft. Starting from near Lake Maggiore, Italy, he flew to Antibes, alighting there in a gale, close to the lighthouse.

Fruit by Air for Covent Garden

It is not improbable, according to the London *Daily Telegraph* that this year a serious effort will be made to enlist the services of the aeroplane for the conveyance of products to Covent Garden. For some time past, Continental growers have been attracted by this new and speedy method of transport. Last year, an early consignment of Dutch tomatoes reached London by an air route. On another occasion strawberries were brought from France by aeroplane; and when an English railway strike was threatened a Belgian grower suggested that he should send his fruit by aerial transport. The aerial service that is now receiving serious consideration is one that would make the aeroplane a link between an important growing center and Covent Garden. Plans have been discussed with the growers, and there is a keen desire to see experiments made this season. It is not, of course, proposed to drop consignments from the air onto the roof of the market; but a landing place not far from Covent Garden has been suggested. The movement is in its initial stage, and developments are awaited with interest.

Air Post to the Rescue Again

Holland and Sweden are feeling the direct effects of the German railway strike, the mails from and through Germany having been completely suspended. Holland at once remedied their part by carrying the mail by aeroplane. Sweden, in a like predicament, is endeavoring also to recommence the air-service for mail-carrying, as the British mails are carried via Germany.

Honoring Aviation in France

The importance attached to the progress of aviation in France may be in part judged by the Legion of Honor appointments just made. These include one "Cravate," three "Rosettes," and seventeen Crosses. M. Clement Ader comes in for the Commander "Cravate," and the officers' "rosettes," fall to MM. Louis Blériot, Georges Bescancon (Secretary-General of the A.C. de F. and Editor of *l'Aérophile*); M. Delage of Nieuport-Delage; and M. René Hanriot. The seventeen Crosses include the Under-Secretary of State for Aeronautics, MM. Lemoine (of Peugeot's); Henri Claudel, of carburetor fame; Dick Farman, brother of Henry and Maurice Farman; L. de Saint-Germain (Gnome and Rhône); and François-Marie Le Men, a prominent commercial aeroplane pilot.

Non-Stop Flight Competition in Japan

The fourth non-stop mail flight, open to civilian aviators, held under the auspices of the Imperial Aviation Society on November 3rd, was participated in by six entrants, only two of whom covering the prescribed distance of 362.5 miles from Kanazawa and Hiroshima. The planes used were either made in Japan or reconstructed from foreign planes. Neither of the two successful entrants covered the prescribed distance within the time limit of four hours, the time for the plane finishing first being 4 hours and 10 minutes, and for the second, 5 hours and 33 minutes.

Aeroplane Markings in Japan

The mark of recognition for the aeroplane is a sun in red, displayed at each end of the upper surface of the upper wing and of the under surface of the lower wing, as well as on each side of the body (or on each side of the frame if the machine is of the frame system). The name of the aeroplane is displayed above the number on the rudder, and the number is displayed in Arabic figures on each side of the rudder, or on each outer side (if there are two or more rudders) and on the under surface of the lower wing with its head to the front.

Progress in Siam

During his "round-the-world" journeying, Lord Northcliffe made a stay at Bangkok, and on December 23rd he visited the aerodrome at Don Muang, where Sir Ross Smith alighted during his Australian flight in 1919. The London *Times* correspondent states that Lord Northcliffe was surprised to find the air station equal to most of those in Europe. Siam, he states, has 25 landing places and five aerodromes. At Don Muang there are 115 planes, including school machines and a staff of 650 men.

Lisbon-Paris Service

The Companhia Portuguesa de Navegacao Aeria, it is reported, intends to open a regular air service between Lisbon and Paris shortly, with intermediary landings at Castello-Branco, Valladolid and Bordeaux. The Portuguese Government has, it is stated, placed the main aerodromes and various intermediary landing grounds on Portuguese territory at the disposal of the company gratis, and has promised that these grounds shall pass into the possession of the company in five years' time. The working capital of the undertaking is stated to be two million escudos. The following lines are projected: Lisbon-Sines-Faro, Lisbon-Panphosa-Opporto, Lisbon-Portalegre-Madrid.

The Polish Industry

The Polish aeroplane industry, which dates back to 1912, was interrupted in its development by the war. Recently, however, an aeroplane plant established in Lublin has again produced a number of machines modeled on the lines of the Balille type developed in Italy. This type has been chosen because it is constructed almost entirely of wood—a prerequisite for Polish aeroplane production, since the metal industry there is not so well developed as in other countries. The machines built in Lublin are of the scout class, supposed to attain a speed of about 200 kilometers an hour, and rising to a height of 5,000 meters in 17 minutes. The motor is of the S.P.A. type, 6-cylinder, 220 h.p. at 1,600 revolutions, and consuming about 48 kilograms of fuel and 3 kilograms of oil in one hour. The rudder, which is operated by the foot, is also of wood and covered with fabric.

Aviation Accidents Decrease in Germany

In reviewing the progress of German aviation, statistics have been published by the German Airship Company, founded after the armistice, showing that during the last three years the number of aviation accidents in proportion to the number of miles covered were no greater than the number of railroad accidents.

The figures show that in 1921, 90 per cent and in some months even 100 per cent of the scheduled flights were carried out without a hitch.

Aviation in Holland

Aviation in Holland comprises the Naval Air Service, the Military Air Service, the Civil Air Service and the Colonial Air Service, all under an Advisory Air Commission. The plan for an Air Ministry in Holland has definitely been given up, at least for the present, though it is doubtful if ever, in time of peace, Naval, Military and Civil Aviation will be united under an Air Ministry. The reason for the defeat of this plan is probably due to the divergent needs of these Air branches and the lack of any strong individual as Air Minister whom these branches could trust with their particular aspirations.

A central purchasing office has been established, to which bids for all material are sent and which does the entire purchasing for all the Air Services. There is likewise one Research Institute, namely, Ryks Studiedienst voor Luchtvaart, which serves all the Air branches and which is paid for by subsidies which are carried on the annual appropriations of the Departments of the Navy, Army and Colonies, and of the Waterstaat.

The Director of the Air Service of the Army regulates and controls his own service without any interference or cooperation, other than that noted below, from any other department. The Chiefs of the various other Air Services do likewise; however, an Air Commission, consisting of the Commander and the Chief Engineer of the Navy Air Service, the Army Air Service, the Civil Air Service, the Colonial Air Service, and one representative from the Ryks Studiedienst meets once a month. This Commission has the authority to definitely decide upon matters of Air policy which are to be made subject to legislation and upon all matters touching the cooperation or assistance to be rendered by one branch to another in any case. At the same time the engineers of the various branches who are present bring up any technical matters of interest which they have discovered or which they desire to have discussed by the Commission as a whole. This Commission has the right to summon before it any technical or other experts or advisors which it may desire. In the opinion of various Dutch Air men the above outline form of "Air Government" will function splendidly as long as there is one strong member on the Commission who is able to effectually direct its activities. The representative for Civil Aviation on the above Commission states that to date there is no outstanding man on the Air Commission and that the activities of this body are not particularly progressive.

ELEMENTARY AERONAUTICS and MODEL NOTES

CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark,
Hotel Nortonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

THE JUNIOR CLUB OF AERONAUTICS,
KANSAS CITY, MO.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

Specifications of the Clark Racing Type Model

THE Racing Type Model, illustrated on the Elementary Aeronautics page of February 27th, built by Jack Clark of the Portland (Oregon) Model Aero Club, has the following dimensions and specifications:

Weight complete.....	8 ounces
Wing area	280 square inches
Wing loading.....	4.11 ounces per sq. ft.
Span, main plane.....	40 inches
Chord	5 inches
Span, elevator plane.....	20 inches
Dihedral Angle, elevator plane.....	0 degree
Dihedral Angle, main plane.....	5 degree
Incidence of main plane.....	0 degree
Incidence of elevator plane.....	4 to 5 degrees
Length of model, overall.....	42.5 inches

Wings are single surfaced, with waxed linen thread trailing edges which give the wing a minimum of resistance, and reduce the wing weight.

Frame members of spruce, tapered from $\frac{1}{4}$ inch square at the center to $\frac{5}{32}$ inch square at the ends. The whole frame is finished in mahogany "Varna-lac." Bamboo cross braces and landing gear.

Propellers are formed in accordance with bent wood practice, but the material used is red fibre $\frac{3}{64}$ inch thick. They are 10.5 inches in diameter and have an actual pitch of 10 inches. The hub is strengthened with tapered pine blocks, laced and glued to the fibre at either side. These blocks are grooved in the center, a bicycle-spoke shaft hooked around them and laced on firmly.

Motive power is supplied by 42 strands of $\frac{3}{64}$ inch square elastic for each propeller, arranged in 41-inch lengths. The elastic used is from the shock-absorber rubber used on the landing gears of large aeroplanes. It is very strong and elastic.

In the first trials held, this model performed very well, getting off the ground in twelve feet. On one flight of 500 feet, the model rose quickly and climbed to about 60 feet, turned, and flew with the wind, terminating its flight by clearing some high electric wires and landing on the roof of a two-story house.

The weather in Portland has been such as to make model-flying difficult, so that the outdoor activities of the P. M. A. Club members is necessarily delayed, but the first good weather will find an enthusiastic group of flyers eager to test the models planned during a very busy winter season.

A "One-Man" Model Winding Rig Invented

Mr. Hubert Burgess, of the Pacific Model Aero Club, San Francisco, has invented a clever rigging device designed to permit a model flyer to wind the elastic strands of twin pusher model aeroplanes without assistance. Ordinarily two persons are required to wind up the elastic—one to do the actual winding, by means of a double acting gear winder, and the other to hold the model frame in position and keep the propellers from rotating during the winding process.

The new winding rig consists of an adjustable arm which can be strapped to a post or tree and provided with hooks to hold the propellers. The arm projects straight out toward the person winding, is adjustable to any height and holds the model rigidly

in the correct position to facilitate easy winding. By its use the model flyer is not handicapped by the lack of assistance in this respect, can save much time by its use and is assured that an inexperienced though willing or a careless assistant will not be the cause of damage to the model. He can preserve the adjustment of the wings and alignment of the propellers with more precision, taking care of all the operations necessary to prepare the model for flight, a feature not to be underestimated, especially when the model flyer is by himself when it is desired to make flights.

Huntington Issues Folder Describing Monoplane

The first description of the Huntington motorcycle-engined monoplane published in AERIAL AGE more than a year ago drew so many inquiries, even until this date, that the many requests for further details have kept the designer busy replying to all these enthusiasts. Mr. D. W. Huntington has prepared a carefully arranged and interesting descriptive folder which gives, in addition to some of the information previously published, a more comprehensive idea of the efficiency of the monoplane design. The folder gives a detailed list of parts required for the ship, accompanied by prices of each.

The broad guarantee extended to purchasers gives the buyer confidence that he will be dealt with fairly. Although it is what AERIAL AGE readers are entitled to in the way of protection, the printed statement "We guarantee all materials and parts we handle to be fully adequate to the uses for which they are intended. Any parts not found as represented will be replaced free of charge or money refunded as preferred" carries with it a knowledge that satisfaction will be assured. Requests for price list and descriptive folder should be directed to Mr. D. W. Huntington, Hempstead, Long Island, enclosing a stamp for quick response.

Standardized Contests Urged Between Foreign and U. S. Model Clubs

A recent communication from the "Norsk Aeromodel Klub" of Kristiania, Norway, suggests that Model Clubs in the United States get into touch with them on the matter of formulating international standards by which contests can be held and records compared upon an equal basis. Some steps on the subject have already been taken with good results. They have established what they term a "standard model," the rubber elastic power unit of which must be equal to 85/100 of the wing span, and the weight of the rubber must not be more than 25 grammes.

Models are classed by the "N. A. K." in three groups: Class A—Stick Models; Class B—Body Models (Scale Models) and Class C—Compressed Air Models. All models are required to have their landing gears secured.

The Club experiments with gliders as well as with models, and being so close to Germany their information on this sport is apt to be extensive. There are two divisions in the Club membership, one for juniors, under 18 years of age, the other for seniors, above that age. Meetings are held the first Saturday of each month and experiments in the open are conducted every Sunday the weather permits.

Those wishing to communicate with this Club should address: Harald Gulbrandsen, Bogstadvi 66, Kristiania, Norway.



Aviation Questions I Have Tried to Answer

By Lt. Hiram Sheridan

(The following story is published through the courtesy of LIFE)

Pardon me, are you the chauffeur? My husband makes automobiles, and I want to know how many miles you get out of your tires.

Ans.—Yes.

Wouldn't you get farther on a gallon if you ran at half speed?

Ans.—You don't say!

I don't see any drive gear from the motor to the wheels. What makes the wheels turn around when you are on the ground?

Ans.—Thy are made out of ouija boards.

What is that fan thing up front?

Ans.—That is to keep the pilot cool when he is answering questions.

Old Lady: There ought to be a law against flying up-side-down when you have girls aboard.

Ans.—Yes'm. So many of us have gone blind.

How do you back up?

Ans.—By flapping my ears.

Is that man cranking that propeller? Isn't that dangerous?

Ans.—Yes, if he gets out of step.

Did you make a good landing last time?

Ans.—All landings are good when you can tell about them afterward.

How can you be sure of stopping the contraption when you land?

Ans.—Land toward a large brick wall.

How does the earth look when you tail-spin?

Ans.—Ask any congressman.

What is aviation good for?

Ans.—It is a sure cure for matrimony if persisted in.

What do you suppose animals think of your being up there?

Ans.—The chickens think it is just fine, but the poor fish are jealous.

Tell me, have clouds really got silver linings?

Ans.—Yes, if you're eloping.

What would you do if the wings came off in the air.

Ans.—Try to sell out.

Are there any laws governing aviation?

Ans.—Yes, one. The law of gravitation.

Is a rainbow ever useful?

Ans.—It's great for shooting the chutes.

If an aeroplane falls with you, what do you do?

Ans.—Sue for non-support.

Do you get killed often in aviation?

Ans.—No, only once.

What, in your opinion, is the greatest need of flying?

Ans.—Roadhouses.

If your motor stops up there, how do you get down?

Ans.—Shave.

Do you get dizzy doing those awful stunts?

Ans.—No, ma'am. I'm used to modern dancing.

Do the wires sing when you are flying so fast?

Ans.—Yes, they sing "Nearer, my God, to thee."

I read that a woman regained her faculty of speech during an altitude flight. What do you think of that.

Ans.—Think altitude flights ought to be prohibited.

Does the lack of oxygen away up there inconvenience you?

Ans.—No, I took some intensive training in cheek to cheek dancing.

So you're in the Air Service! What is your official capacity?

Ans.—Two quarts.

Can your compass tell you where to go?

Ans.—No, we have majors for that.

Do you wear goggles all the time?

Ans.—No, only when attending socials—to keep the lady-dust out of my eyes.

Do you have to begin at the bottom and work up, when in the aviation?

Ans.—You do—unless you're a parachute jumper.

Does your face get wind burned?

Ans.—I don't attend teas.

Do the birds ever annoy you?

Ans.—Well, when I forget to shave, they sometimes hang

around like they were waiting to nest.

Why did you give up mining for aviation?

Ans.—My essential egotism. I'd rather fall on the earth than have it fall on me.

Wife (showing furs, a present from husband)—"Fancy such lovely furs coming from a little skunk!"

—Passing Show (London).

I Ask You

She broke a date with me

One night

And later she explained

She had spent the night with

Friend Isabelle.

Now what could I do

For I had spent

That whole same evening

With

Isabelle

Myself?

—Jack-o-Lantern.

Rubbing It In

Citizen—"Judge, I'm too sick to do jury duty; I've got a bad case of the itch."

Judge—"Excuse accepted; clerk, just scratch that man out."

—Widow.

Watch—"Why does that man always refer to you as his baby girl?"

Fob—"Oh, I don't know, I suppose it's because I keep him up so late of nights."

—Frivol.

An Epitaph

Here lies my wife,

Here let her lie,

Now she's at rest;

So am I.

—Lehigh Burr.

Sporting Goods

Dark Skin—"Ah wants fo' to buy a razah."

Obliging Clerk—"For shaving or social purposes?"

—Orange Owl.

The Aeroplane Wins

Most prophesying is mere guess work, built on shifting sands, And I never like to do it, but I'll take a chance. Now all this scrapping, scrapping, of powerful battlefleets, That has all been agreed upon, at the Washington meets, Has come because wise men have seen the writing in the sky Concerns these here onory things, you know these things that fly,

Can sink the most powerful battleship, with just one square shot,

And a few over a large City, can make of it a blot.

They can spread the plague, disease and death upon a whole land,

By dropping terrific bombs and gas, germs and fire brands.

Here the writing on the wall comes in, now they have said,

Stop work on forts and battleships, and work on planes instead.

We do not care how many you built, we'll not interfere,

Now these here statements from the meets, make the whole thing clear.

The next war that comes along will be fought in the air,

By powerful battle air fleets, who'll be everywhere.

I regret to say that wars will come, and still they will come,

Until there's a U. S. of the world, ringing with freedom.

But these coming wars will be the last, because of Aeroplanes,

They'll be too fierce for the fiercest men, and then the brains,

Will stop all war because of Planes, and then their future be-

gins,

To carry passengers and freight, the AEROPLANE wins.

H. Theo. Haller.

AERIAL AGE

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MARCH 20, 1922

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Raymond D. Harris
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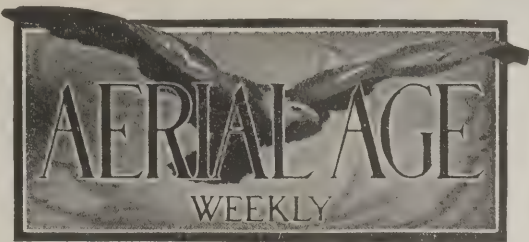
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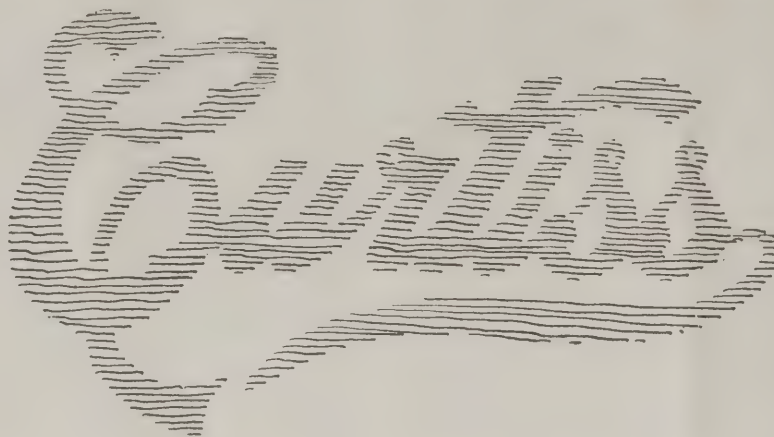
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DELIVERING a 3-place Lincoln Standard Tourabout to Messrs. Bell and Long of Kansas City, Mo., December 21st, 1921, at zero temperature. (Note the aluminum covering on lower half of the radiator.) On account of the extreme weather conditions their flying instruction was transferred to the Oklahoma City flying field.

Nebraska Aircraft Corporation
Lincoln, Nebraska



Announcing 1922 Price List

NEW PRODUCTION

ORIOLE:		LIST PRICE
With OX5 Motor		\$3000.00 F.O.B. Buffalo, New York
With K-6 Motor (1919)		4400.00 F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces..		4800.00 F.O.B. Buffalo, New York
SEAGULL:		
1919 K-6 Motor, dual stick control		5200.00 F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons		5600.00 F.O.B. Garden City, L. I.
STANDARD:		
With C-6 or K-6 Motor.....		3600.00 F.O.B. Garden City, L. I.
MOTORS:		
C-6 or K-6 (150 H.P.).....		3000.00 F.O.B. Buffalo, New York

GOVERNMENT TRAINING PLANES

JN's:		
JN4D with new OX5 Motor		\$2400.00 F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor		\$1200.00 to 2200.00 F.O.B. Dallas, Texas
STANDARDS:		
With new OX5 Motor		2000.00 F.O.B. Houston, Texas
With overhauled OX5 Motor.....		1700.00 F.O.B. Houston, Texas
Without motor, rebuilt for OX5		1100.00 F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6		1600.00 F.O.B. Garden City, L. I.
Without motor, as received from Government..		800.00 F.O.B. Houston, Texas

MOTORS:		
OX5 New		800.00 F.O.B. Various concentration fields
OX5 Overhauled		600.00 F.O.B. Various concentration fields
OX5 As received from Government.....		500.00 F.O.B. Various concentration fields

NOTE: Where delivery is made from other than F.O.B. points, accrued transportation charges must be added.

WRITE FOR DETAILS IF INTERESTED IN BECOMING A DISTRIBUTOR OR DEALER, STATING TERRITORY DESIRED.

CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY



LONG ISLAND, N. Y.



*With which **Flying** is consolidated*

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An Appeal to the American People to Save Aeronautics

As a nation-wide organization representing all elements in aviation, the Aeronautical Chamber of Commerce of America regards it as a responsibility and duty to call to the attention of the country the following facts:

The Army Air Service, Naval Aviation, and the National Advisory Committee for Aeronautics—necessary factors in our national defense—are in danger through public ignorance or apathy.

Since the conclusion of the World War, appropriations for the Aerial Arm have steadily diminished.

	1920-1921	1921-1922	1922-1923 (proposed)
Army	\$33,000,000	\$19,200,000	\$15,210,770
Navy	\$20,000,000	\$13,413,431	\$17,043,310

In the summer of 1921, aircraft decisively demonstrated their right to recognition as a potent and economical arm—particularly in Coast Defense—by destroying, one hundred miles at sea, examples of the most modern construction in surface fighting ships. The crash of the 2,000-pound bomb which sank the dreadnaught *Ostfriesland* was, as the Chief of Ordnance declared, “A shot heard round the world!”

At the recent Conference on the Limitation of Armaments naval reductions were agreed upon, which, it is estimated, mean a saving of \$5,000,000,000 in taxes to the citizens of the United States, and of many billions more to those of Great Britain, France, Italy and Japan. At the same time, the Conference refused to limit the Aerial Arm, but, to the contrary, adopted recommendations looking toward its development.

In all the countries participating (except the United States) and also in Germany, which did not participate, the policy of encouraging aviation has been adopted. In the last fiscal year, Great Britain appropriated approximately \$95,000,000 for its Air Service. France appropriated approximately about \$87,000,000. Italy about \$7,000,000. And Japan, while figures are not forthcoming, is reported to have an industrial air establishment which rivals, if it does not surpass, the shrunken aeronautical resources of the United States.

Following the scrapping of a part of our Navy, an effort was made to balance this loss by converting two of the battle cruisers under construction into aircraft carriers (H.R. 10,647). Although we have no aircraft carriers, this bill has not yet received consideration.

The National Advisory Committee for Aeronautics, one of the powerful instruments in co-ordinating our efforts in the

World War, and since then the only official body in existence striving consistently and solely for the development of scientific, commercial and military aeronautics, is in immediate danger of dispersion, as the Senate has voted down the two hundred thousand dollars or so asked for the new fiscal year. And this at a time when Great Britain, observing our experiences, is creating a similar Advisory Committee.

The amounts proposed for our Air Service in 1922-23 (Army \$15,210,770; Navy, \$17,043,310) are now before the Appropriations Committee and it is reported that they are to be cut. The suggestion comes from the belief that, if the Army is to be reduced, all branches must be reduced in equal proportion. But this can not be wisely applied to Aviation, which is the one instrumentality that has not been completely developed. It is the Arm which, even in its present state, revolutionized our Coast Defense and contributed directly toward saving vast sums in military and naval expenditures, and which in case of future war, will be our first and foremost protection from the enemy.

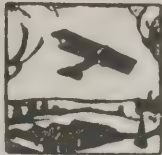
These are the facts: We can not safely dispense with most of our Navy, practically all of our Army and then destroy the very instrument which made these economies possible. Wisdom and national policy demand an Air Service in the Army and Navy, through the approval of the extremely modest amounts requested in the Army and Navy Appropriation bills, the construction of aircraft carriers, as provided for in H.R. 10,647, and retention of the National Advisory Committee for Aeronautics.

Commercial Aeronautics in Europe

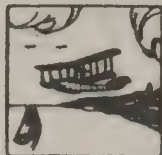
AERIAL AGE is fortunate in being able to present to its readers the comprehensive series of articles, which start in this issue, on “Commercial Aviation Developments in Europe,” written by William Knight, M.E. Mr. Knight is probably the best informed writer on European aeronautic affairs now in America, and his excellent sources of information in Europe enable him to secure the most authoritative information available.

AERIAL AGE believes that the present is an excellent time to give the real facts concerning developments in Europe, so that the American industry may benefit from the stimulus the facts present.

Activities in France, England, Belgium, Italy, Germany, Rumania, Switzerland, Spain, Norway and Holland will be dealt with.



THE NEWS OF THE WEEK



120 Miles by Air to Hospital

Norfolk, Va.—Bringing a man ill with pneumonia 120 miles in an ambulance aeroplane in the teeth of a fifty-mile easterly gale at night is the feat performed by a navy crew and Dr. J. D. Benjamin, U. S. N. The sick man was V. E. Squires, a life saver attached to the Poyners Hill Coast Guard station, an isolated spot on the North Carolina coast.

Squires, who had been ill for several days without medical attention because no doctor was near, was at the point of death when a radio message was sent out for assistance. Admiral Rodman, commanding the 5th Naval District, ordered a navy ambulance plane and a doctor to go to his assistance. The plane was piloted by Boat-swain Claude Tucker.

The trip to Poyners Hill was made in sixty-eight minutes and the trip back to Norfolk with the patient was made in seventy-four minutes. Squires was unconscious, with a high fever, when the aeroplane arrived at its destination. He was placed in a bed immediately and given medical attention by Dr. Benjamin. The plane was equipped with medical supplies.

During the flight back to Norfolk Dr. Benjamin continued treating the sick man. His fever was one degree lower when they reached here. The plane landed Squires almost at the door of the Public Health Hospital at the naval base.

The "Petrel" Carrying Passengers From Frozen St. Lawrence River

Flying one of the stock, "Petrel," three-seaters, George B. Post, of Huff, Daland Company made use of a novel landing field when he carried passengers from the surface of the frozen St. Lawrence River in front of the Company's plant recently. Snow drifts from eight to twelve inches deep were encountered, greatly handicapping the take-off and landings, but the flying was accomplished without serious difficulty.

During tests which were witnessed by Company officials and Mr. G. A. Giroux, the resident Naval representative at the Plant, and carrying the full military load with two passengers and four hours fuel, the machine made the remarkable climb of 7,000 feet in twenty-two minutes with an initial climb rate of 510 feet per minute, while later in the afternoon it put over a measured mile laid out upon the ice, and in a series of eight runs with and against a four mile wind, showed an average speed of 88 miles per hour with a maxi-

mum of 93 miles per hour in the first two trials. So far as is known the climb and high speed established are greatly in excess of anything ever before approached with the OX-5 motor.

The Catron-Fisk Airline

Catron and Fisk, of Los Angeles, have established an air line between Los Angeles and Bakersfield. Six passenger triplanes are used on a daily schedule, leaving Los Angeles at 9.30 a. m., arriving at Bakersfield at 11 a. m. and leaving Bakersfield at 3 p. m. and arriving in Los Angeles at 4.20 p. m. The fare is \$12.50 one way and \$20.00 round trip, and the line is already successful in operation.

The view is unsurpassed on this trip as the plane flies over the Ridge above Saugus. The Ridge is now covered with a mantle of snow which adds to the beauty of the trip. The time by rail to Bakersfield is seven hours and by Motor Transit five hours—therefore the saving in time is a great item, and the difference in fare is not great, the ground rate being about \$6.90 one way and \$13.50 round trip.

Stinson Buys Junker Planes

Eddie Stinson has bought four Junker planes from the government and intends to operate them in commercial service between two points of enough distance to make them of commercial value. These machines are to be overhauled by American workmen using all American material.

Early Aerial Mail Suggestion

Postmaster General Hubert Work thinks it is time, after 100 years, to publicly acknowledge the friendly advice of the editor of the Freeman's Journal (now called the Norristown, Pennsylvania, Herald) of March 1, 1822, given to the then Postmaster General, Return J. Meigs, Jr. The early editor, who in the usual fashion designated himself as "we," wrote in the Freeman's Journal as follows:—

"We would advise the Postmaster General to avail himself of the novel and very ingenious flying machine, invented by James Bennett, of Philadelphia, by which we conceive, the mails would be transported with much more celerity and their arrival at the places of destination be much more certain than is the case at present."

In appreciation of what the Air Mail Service has done and in approval of its development, Postmaster General Work said: "If that was true then, it is true

today, and I wish I might be able to advise this old editor that we are today using the "flying machine" with splendid results in transporting the mails with safety and celerity."

The records of 1833 in the Post Office Department show that a "wonderful feat" was performed in carrying the mail and news dispatches, by relays of horses every five miles, between Washington and New York, in 15 hours. It created the greatest enthusiasm along the way as the rider appeared in a cloud of dust and leaped to the saddle of another horse. The records of the Post Office Department also refer to the unfortunate death of one of the riders on this trip who was thrown from his horse. Thus, in the development of speed in carrying mails, human life was sacrificed, even in the use of horses. Last year 1,000,000 miles were flown in carrying the mails by air, with but one loss of life and that occurred on a plane not carrying mail.

Do Not Stunt DH4B's

The office of the Chief of Air Service notifies the following:

1. The attention of all concerned is invited to the fact that the DH4B aeroplane is not designed to stand the strains involved in the performance of loops, Immelmann turns, spins or rolls. The DH4B should not be "rolled" under any circumstances, nor should a dive at a speed in excess of 150 m.p.h. be made.

2. Strengthening or making changes in DH4B aeroplanes with a view of their use in acrobatic flying will be done only on the approval of the Chief of Air Service and in accordance with instructions prepared by the Engineering Division, McCook Field.

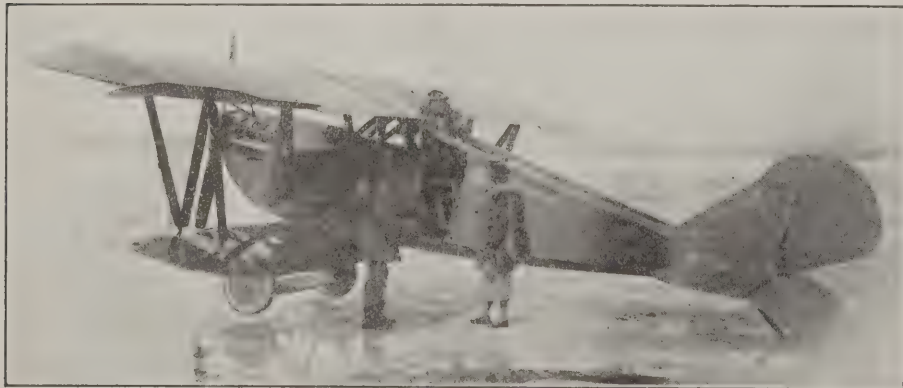
COMING AERONAUTICAL EVENTS

AMERICAN

- Apr. 30.—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.
- May —National Balloon Race.
- Sept. 4.—Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
- Sept. 15.—Detroit Aerial Derby, (about) Detroit. (Pulitzer Trophy Race.)
- Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

- Aug. 1.—Coupe Jacques Schneider. (about) (Seaplane speed race.) Italy, probably Venice.
- Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.
- Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.



The Huff-Daland "Petrel" carrying passengers on the frozen St. Lawrence. George B. Post, pilot.

The AIRCRAFT TRADE REVIEW

General Air Service Incorporators

In our March 6 issue we published an article by Clifford A. Tinker discussing the plans and personnel of the American Investigation Corporation and General Air Service. We have since secured a more complete list of the incorporators, which is as follows:

Allderdice, Taylor, Vice President, National Tube Company, Pittsburgh.
 Bai Lihme, C., President, Mattheissen & Hegeler Zinc Company, Chicago.
 Benet, L. V., President, Hotchkiss Company, Paris, New York.
 Bertron, S. R., President, Bertron, Griscom & Company, New York.
 Black, John D., Attorney, Chicago.
 Boeing, W. E., President, Boeing Airplane Company, Seattle.
 Bolton, Chester C., Capitalist, Cleveland.
 Brooks, Charles F., Lawyer, Cleveland.
 Chandler, C. DeF., U. S. Army, (retired), Washington.
 Clark, Edward H., President, Homestake Mining Company, New York.
 Crowell, Benedict, President, Crowell and Little Construction Company, Cleveland.
 Culver, C. C., Lieutenant Colonel, U. S. Army, Washington.
 Davis, Arthur V., President, Aluminum Company of America, Pittsburgh.
 Dunham, L. I., Capitalist, New York.
 Fahnestock, Snowden A., Bertron, Griscom & Company, New York.
 Field, Marshall, Capitalist, Chicago.
 Goodrich, David, Goodrich, Lockhart Company, New York.
 Hanna, L. C., Jr., Capitalist, Pittsburgh.
 Hardesty, Fred S., Consulting Engineer, Washington.
 Herr, E. M., President Westinghouse Electric and Manufacturing Company, Pittsburgh.
 Hilliard, W. H., Capitalist, Pittsburgh.
 Homer, Francis T., Bertron, Griscom & Company, New York.
 Johnson, Crawford, Capitalist, Director First National Bank, Birmingham, Ala.
 Joyce, W. B., President, National Surety Company, New York.
 Kenley, W. L., General, Marland Oil Company, Oklahoma.
 Kirby, John H., Capitalist, Houston.
 Lockhart, James H., Capitalist, Pittsburgh.
 Lovejoy, J. R., Vice President, General Electric Company, New York.
 McCune, John R., President, Union National Bank Pittsburgh.
 McDonald, John R., President, First National Bank, Erie.
 McEldowney, H. C., Chairman, Union Trust Company, Pittsburgh.
 McRoberts, Samuel, Capitalist, New York.
 Marland, E. W., President, Marland Oil Company, Oklahoma.
 Mellon, R. B., President, Mellon National Bank Pittsburgh.
 Mellon, W. L., President, Gulf Oil Company, Pittsburgh.
 Mudge, E. W., Steel Operator, Pittsburgh.
 Penton, John, President, Penton Publishing Company, Cleveland.

Pratt, Theodore, Standard Oil Company, New York.

Remington, Franklin, President, Fountain Corporation, New York.

Richardson, William E., Lawyer, Washington.

Roosevelt, Franklin D., Vice President, Fidelity & Deposit Company, New York.
 Schildhauer, Edward, Consulting Engineer, Washington.

Shaw, Wilson A., President, Bank of Pittsburgh, Pittsburgh.

Squire, Andrew, Lawyer, Cleveland.

Stevenson, Lewis G., Farmer, Bloomington, Ill.

Thaw, Benj., Capitalist, Pittsburgh.

Wilson, Thornton, R. T. Wilson & Company (bankers), New York.

Winston, Hamden, Real Estate, Chicago.

Wrigley, Philip N., Vice President, Wm. Wrigley Company, Chicago.

Young, Owen D., Vice President, General Electric Company, New York.

Browne Heads Curtiss Commercial Sales

The Curtiss Aeroplane and Motor Corporation announce that they have acquired the services of George W. Browne as the head of their commercial sales department. Mr. Browne will be assisted in this work by F. W. Whitney.

Opens Sales Office in Middle West

Huff Daland & Co. announce the opening of a sales office and flying field for demonstration purposes in Kansas City, Mo. The business will be handled by the Huff Daland Aero Corp, sole distributors of aircraft for the manufacturing company. Archibald B. Johnston, sales manager, and George B. Post, vice-president, will control the western territory and offices have been opened at 1018 Commerce Building, Kansas City, Mo., with a flying field in connection with the Flying Club of Kansas City nearby.

One of the new "Petrel" three seated commercial machines, described in detail in the February 6th issue of AERIAL AGE, has already been shipped to the Western field for demonstration purposes.

Airco Ignition Gauge

The Airco Ignition Gauge, placed on the market by the Edward A. Cassidy Company, Inc., 25 West Forty-third street, New York City, has attracted the enthusiastic support of the local aeronautical interests. The gauge is a compact vest-pocket instrument which enables flyers instantly to detect faulty spark plugs and locate short circuits; also leaks of current in the wiring between the plugs and the coil and magneto. The test itself is the functioning of an electrical flash in the gauge. The color of the flash determines the condition of the plug or wire.

An Interesting Pamphlet

AERIAL AGE is in receipt of an interesting pamphlet entitled, "Aviation: Its Development, and its Relation to the National Defense," being a paper read before The Contemporary Club, Davenport, Iowa, by Ralph W. Cram, Editor of *The Democrat*, that city.

Aviation School Circular

The Ralph C. Diggins School of Aeronautics have just issued a new circular concerning their School of Flight which should be in the hands of everyone contemplating a flying course this summer. The Diggins School has made a remarkable record in the training of pilots, and the plans for the coming season would indicate that they are out to better their record.

Personal Par

B. Hyde Pearson recently left New York for Mexico City, where he has gone in connection with the setting up of Avros for the Mexican concern. His friends can communicate with him in care of the American Consul, Mexico City, Mexico.

Why Experts?

In the development of a young industry like aviation, the use of the term "experts" invariably becomes misallied and misapplied. "It is a broad, general term," says Leslie B. Coombs, Chief Engineer of the Central Aeroplane Works, "which may be claimed by many men in the industry, yet who do not desire the title. Others appropriate it and use it who have little theoretical knowledge and some practical experience, or vice versa."

Mr. Coombs recently compiled from all available sources and his own experience, data which he has grouped under subject headings, showing the many branches for specialization, and the composite representing the ideal of the "Aeroplane Expert."

This interesting information has been printed for its actual value to members of the organization and as a matter of general information in the form of a booklet titled "Your Chance to Become an Aeroplane Expert." Several thousand copies have already been distributed without charge and a second issue is now on the press.

Simplified Theory of the Magneto

This paper (Report No. 123 N. A. C. A.) contains part of the results of ignition investigations being made for the National Advisory Committee for Aeronautics at the Bureau of Standards, and describes a type of circuit which has been found useful for representing the action of the high-tension magneto. While this equivalent circuit is relatively simple, and consequently can be used as a basis for deriving definite mathematical formulas for induced voltages and similar quantities, it has been found experimentally to correspond quite closely in its performance with the highly complicated electrical circuits of an actual magneto. In the paper formulas are given for the voltage induced in the secondary under various conditions of operation, and a number of numerical examples are worked out showing the application of the equations to a variety of practical problems.

A copy of Report No. 123 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

COMMERCIAL AVIATION DEVELOPMENTS IN EUROPE

By W. KNIGHT, M. E.

COMMERCIAL Aviation in Europe, since 1919 has been largely patronized by American tourists travelling abroad, who have been very much impressed with the regularity and the convenience of this new transportation service. It seems that a surprisingly large percentage of passengers on board the European Aerial Express were Americans.

Americans in the United States have also flown a good deal, in fact, according to estimates based on reports received from operators of aircraft all over the country, 225,000 passengers have been carried during the year 1921, and about 6,000,000 miles have been flown during the same period by both commercial and privately owned aeroplanes.

The Air Mail Service in the United States, stands up to date as the best organized, the biggest and the most efficient accomplishment of commercial aviation in the world. In fact, during the first nine months of 1921, 1,332,000 miles were flown with mail and 6,350 flights were completed. These figures representing 95% of the flights attempted in the same period of time.

It is out of the question that the people at large in this country are more familiar with flying and its potential possibilities, than the people of any other country of Europe, and the establishment and development of a regular aerial service linking together the most important centers of the United States must necessarily find a more ready acceptance on the part of the American public, than it was the case with the European public during the last two years.

In Europe, a regular inter-city and international air service has already been in operation during almost 2½ years and it has kept increasing in volume and importance at a very gratifying rate, during this period of time and especially the last year.

By starting to organize commercial aviation on a large scale in this country, more than two years after Europe did, we have the advantage of being able to capitalize the experience gained by European Aerial Operating Companies and the progress made in aircraft design and aircraft equipment during the last two years. Furthermore, we are in a position today to visualize right at the beginning of our organization that aerial navigation is going to be in the near future a tremendously important factor in the development of international trade and we can keep this in mind while working out our plans for the immediate future.

If we shall be able from now on to establish and to maintain a cordial exchange of information and data between commercial aviation interests in this country and in Europe, in a true spirit of a mutual helpfulness, a good many errors and a great deal of dispersion of energies might be avoided in the future, and the foundation can be gradually established for a more intimate contact on a business basis between commercial aviation interests in this country and the rest of the world.

The following is a brief résumé of recent developments of civil aviation in Europe.

FRANCE

Government Organization of Aerial Services

The organization of civil aviation in France, was started in about September 1918. From September 1918 to June 1919, not much was done outside of the organization of postal services by the Governmental administration of the French Post Office Department. The lines Antibes-Ajaccio, Paris-Saint Nazaire, Nice-Avignon, Paris-Lille, Paris-Bruxelles, were operated with aeroplanes supplied by the Navy and the War Department and also the lines Paris-Bordeaux, Paris-Maubeuge-Valenciennes, Nancy-Briey-Longwy, Paris-Londres, were operated with aeroplanes supplied by the Bureau of Civil Aviation of the War Department. The lines, Paris-Strasbourg and Paris-Mulhouse were operated by the command of the French army. The operation of these various lines by the government directly proved the necessity of creating a central organ of coordination of aeronautical services. So it was that in June 1919, the "organ of coordination of aeronautics and aerial transports" was created, and the various services operated up to that time by the War, Navy and Post Office Department were put under the control of this newly created central governmental organization.

In January 1920, an "under secretariate of state for aeronautics" was created grouping under its supervision the three services which were previously under the organ of coordination of aeronautics and aerial transports, namely: the technical service, the aircraft manufacturing service and the service of aerial navigation. From that time on, the organization of

flying fields and aerodromes, in a systematic way all over the country were started, and an extensive wireless and meteorological service has been developed during the last two years.

The aero-port of Bourget (Paris) which is the most important aero-port in France is connected by wireless directly with Londres-Croydon, Lympe-Bruxelles, Amsterdam, Saint Inglevert, Strasbourg, Nancy, Maubeuge, Valenciennes, Romilly-sur-Seine, Dijon, Lyon, Le Havre and by relay with Bordeaux, Toulouse, Marseilles, Montelimar, Perpignan, Nimes, Bayonne, Antibes and Ajaccio.

The meteorological organization in France is divided into six zones, (Paris, Metz, Tours, Lyon, Bordeaux, Marseilles) which collect the meteorological data as affecting aerial navigation in France and communicate them to the Bourget aero-port, which also receives information of atmospheric conditions abroad through the central National Meteorological Bureau.

Night flying is facilitated by an extensive installation of search-lights, in the various centers all over France. The Paris-Londres route already has a complete line of lights with a range of some twenty miles each. In order to assist the pilots, however, it has been recently decided to build two search-lights with a range of over 100 miles. One of these will be erected on a tower on Mount Afric, near Dijon and the other at Mont Valerien just outside of Paris. It is anticipated that a whole system of lighthouses throughout France shall be completed in the near future, including specially colored lights on the aerodromes. A pilot will carry printed instructions similar to navigation rules at sea; the various lights indicating what ground is below.

Of all European nations, France is the one that is actually showing the most lively interest in the organization of aeronautics. The men at the head of the French Air Service are evidently imbued with the greatest confidence in the future of civil aviation and therefore, with a desire to create a strong organization.

The policy of the undersecretariate for aeronautics is as follows:

To create a national network of aerodromes, to organize a meteorological and wireless service, to commence the construction of rigid airships and to afford pecuniary encouragement to aerial navigation companies and to aircraft manufacturers.

The budget for the undersecretariate of French aeronautics amounted to 128,794,930 francs in 1921 and an increase of 56 millions over these figures was asked for in the course of the year. Actually, almost 500,000,000 francs were spent for aeronautics in France during 1921.

The aeronautical program for the year 1921 included the creation of an aero-port at Orly and the construction of two rigid dirigibles, the sum of 16,000,000 francs having been requested to cover these expenses. The work at Orly was started in 1920 and the two rigid dirigibles are to be completed by 1922. Work for establishing a number of hydroplane bases in the basin of the Mediterranean at Antibes, Marseilles, Perpignan and Tunis-Bone-Algiers-Oran-Azamour-Agadir has already been started, clearly pointing to further expansion of aerial lines in the Mediterranean and in the North African French colonies. It is stated that the aero-port of Constantinople established by the French Military Mission will be attached to the French undersecretariate of aeronautics and will function under the same conditions as a French aero-port.

The technical section of aviation is completing its installation at Villacoublay and Issy-les-Moulineaux and the sum of 48 millions was requested by the undersecretariate of aeronautics for completing the studies and experiments undertaken by the technical section of aviation and for subsidizing aircraft and aerial engine manufacturers and also for running the plant established at Metz for producing the hydrogen required for balloons and dirigibles.

Commercial Operation of Aerial Services

The exploitation of regular commercial aerial lines in France was not really started before 1919. In 1919, four aerial companies started a regular service for passengers, mail and parcels, between Paris, Lille, Bruxelles, Paris-Londres, Toulouse-Rabat, and other lines such as Paris-Cobourg, Paris-Deauville, and Bayonne-Saint Sebastian were operated only during a few months of the year.

The aeroplanes used for these services were all aeroplanes obtained from the army and therefore not designed for commercial purposes, being as they were simply changed over from war service to commercial service in a more or less in-

efficient manner. This coupled with the fact that the public in France had not much confidence in this new means of transportation, made it a necessity for the government to subsidize the operating companies, which could not otherwise have survived the financial failure of these lines.

At the present time, after two years of operation, the aerial transport companies in France are yet very far from being in good financial shape. The aeroplanes used at present, are with a few exceptions a modification of the war aeroplane, such as the Breguet limousine, the Goliath F60, the Salmson limousine, the Potez 9 limousine and the new types designed on the same principles of the war types, such as the Berline-Spad-33.

From table No. 1, we can see that the trend of evolution of the design of aeroplanes, since 1919, has been to increase the useful load available, which is, of course, the logical step in

the right direction for commercial aviation purposes. The average value of the ratio: useful load divided by total load of commercial aeroplanes being in service in 1921, is on the average of about .30.

While in 1919, four companies were operating regular aerial services, the number of these companies increased to ten in 1920 and in 1921 eight were in existence, two having been disbanded. The lines in operation at the end of 1921, doing regular service are Paris-Bruxelles, (which was extended to Amsterdam during 1921); Paris-Londres, Toulouse-Rabat (which was extended to Casablanca in 1921); Bayonne-Bilbao, Paris-Geneva, Paris-Strasbourg-Prague, which in 1921 was extended to Warsaw; Bordeaux-Toulouse-Montpellier, Nîmes-Nice, St. Laurent-Cheyenne, Paris-Havre, Antibes-Ajaccio,

(Continued on page 32)

CIVIL AVIATION IN FRANCE

TABLE 1

	1919 Sept. 1 to Dec. 31	1920	1921 Jan. 1 to Sept. 1
1 Extension of operation zones.....miles	1,540	2,675	3,080
2 Pilots in service	27	71	102
3 Airplanes in service	46	183	263
4 Horsepower available	13,300	54,000	80,000
5 Useful load available.....tons	16	83	110
6 Percentage of scheduled trips } Paris-London 75 95 36 being actually } Paris-Brussels 77 93 92 completed } Toulouse-Casablanca 93 96 97			
7 Trips made	1,490	2,381	4,479
8 Total miles flown	200,000	525,000	960,000
9 Total number of passengers carried.....	527	982	6,387
10 Average miles flown per trip.....	134	220	215
11 Average number of passengers carried per trip .....	.35	.41	1.42
12 Total express matter carried.....tons	7.5	.54	112
13 Total mail carried .....	.44	4.4	6
14 Average express matter carried per trip	10	45.5	51
15 Average express matter carried per mile .....	.075	.2	.24
16 Average mail matter carried per trip.lbs.	.59	3.7	2.65
17 Average mail matter carried per mile.lbs.	.0044	.017	.012
18 Number of lines operating regularly....	3	9	11
19 Customs duties paid to the French Gov. on express matter at Bourget (Paris), Aeroport only	17,835	312,724	560,000
20 Estimated total revenues of operating companies	45,000	720,000	2,400,000
21 Estimated revenues of operating com- panies per trip.....	30	300	540
22 Estimated revenues of operating com- panies per mile.....	.225	1.37	2.5
23 Estimated average cost of operation per mile flown based on the experience of Bourget operation on Paris-London line only	14.50	14.50	14.50

TABLE 2

Total number of passengers, mail and express matter carried by French and other aerial lines passing through the Bourget (Paris) Aeroport from May 1st to Oct. 31st, 1921.

Date	Passengers	Express Matter Tons	Mail lbs.
May	1532	13	670
June	2036	15	740
July	2285	13	880
August	2473	17	840
Sept.	1418	18	1150
Oct.	1250	21	820
Total	10,994	97	5100

TABLE 3

Total number of aeroplanes, passengers, mail and express matter passing through the Bourget (Paris) Aeroport during Sept. and October, 1920 and 1921.

	Passengers	Aeroplanes	Express Matter Tons	Mail lbs.
Sept. 1920	1190	451	14	1090
Sept. 1921	1418	433	18	1150
Oct. 1920	961	444	16	1370
Oct. 1921	1250	408	21	820

TABLE 4

Air Mail Rates—France and Colonies
(Law of Oct. 10, 1919)

	0 to 20 gr.	21 to 100 gr.	101 to 200 gr.
0 to 500 Km.....	.75 fr.	1.50	2.25
501 to 800 Km.....	1.00 fr.	2.00	3.00
801 Km. and more.....	1.25 fr.	2.50	3.75

TABLE 5

France and Colonies
(Law Jan. 13th, 1921)

	0 to 20 gr.	21 to 100 gr.	101 to 500 gr.
For any distance.....	.75 fr.	1.75 fr.	1 fr. for every 100 gr. or fraction of

TABLE 6

Paris-London

	Law of Sept. 29, 1919	Law of Aug. 27, 1920	Law of May 1, 1921
For 20 grams or frac- tion of	3 fr.	.75 fr.	.50 fr.
Additional charge of 1 fr. for Special Delivery.			

TABLE 7

Air Mail Rates

Paris-Bruxelles-Amsterdam

Paris-Bruxelles

Law, June 30, 1920 Law, May 1, 1921 Paris-Amsterdam
Law, May 1, 1921

For 20 grams or
fraction of, up
to 100 gr..... .75 fr.

For more than
100 gr.....Frs. 3.75 for
first 100 gr.
plus .50 fr.
every 20 gr.
or fraction of,
from 101 gr.
up

For 20 grams
or fraction of
from 0 gr. up.....

Additional charge of 1 fr. for Special Delivery

TABLE 8

Air Mail Rates

France-Hungary-Poland

(Law Feb. 22, 1921)

	0 to 20 gr.	21 to 100 gr.	101 to 200 gr.	For every 100 gr. or fraction of up to 2 Kg.
Paris-Strasbourg	.75	1.50	2.25	
Paris-Prague	1.25	2.25		.50
Paris-Warsaw	1.75	3.00		.75
Strasbourg-Prague	.50	.75		.25
Strasbourg-Warsaw	1.00	1.50	.25	
Prague-Warsaw	.50	.75		.25

TABLE 9

Passengers, Mail and Express Matter Rate
French Aerial Lines

Operating Company	Route	Distance in miles	Mail 20 gr. Frs.	Express Per lb. Frs.	Matter Per ton/mi. Frs.	Passengers Per Pass. Frs.	Passengers Per Pass./mi. Frs.
Messageries Grand Express....	Paris- London	233	.50	2.26 to 3.4	19.5 29.3	300	1.28
Messageries	Paris- Bruxelles	161	.30	1.36 to 1.82	16.9 22.6	175	1.08
Messageries	Paris- Amsterdam	273	.50	2.26 to 2.93	16.7 21.5	300	
Farman	Paris- Amsterdam	273	.50	1.36 to 1.82	10.0 13.3	300	1.1
Franco-Romaine	Paris- Strasbourg	249	.75	1.14	9.2	150	.6
Franco-Romaine	Paris-Prague	560	1.25	3.18	11.2	500	.9
Franco-Romaine	Paris-Warsaw	870	1.75	4.08	9.4	800	.92
Luteovere	Toulouse- Casablanca	1140	.50	4.08	7.15	1516	1.36
Franco-Bilbaire	Bayonne- Santander	124	.25	1.14	18.4	150	1.20
Messageries	Paris- Sattano	186		1.58	17.0	200	1.08
Ernoult	Bordeaux- Montpellier	260		3.00	23.0	176	.68
Seneme-Francaise ...	Nîmes-Nice	216		2.04	18.9	240	1.1

TABLE 10

Air Mail Rates

France-Spain

	0 to 20 gr.	21 to 100 gr.	For every 100 gr. or fraction of up to 500 gr.
Bayonne-Santander ....	.25 fr.		
Toulouse-Barcelone- Alicante-Malaga .....	.50	1.50	.75

and in the near future the new line Marseilles-Alger is going to be opened.

The regularity of the aerial services is greatly improved since 1919, as we can see from table No. 1. 96% of the scheduled trips on the Paris-Londres route took place from January first to September first last year. 92% of the scheduled trips were completed on the route Paris-Bruxelles and 97% on the route Toulouse-Casablanca. The number of the aeroplanes in service, has increased from 46 in 1919 to 263 in September 1921, and the total h.p. available on these aeroplanes is correspondingly increased from 13,300 to 80,000 h.p.

Statistics compiled by the operating companies show that most of the passenger service carried on in 1919 and 1920 was due to American, English and Japanese tourists, and business men most of whom were Belgians and Germans. French tourists and business men have been in the first two years of operation, surprisingly shy of using this new means of transportation. Conditions, however, during 1921 have noticeably changed and from 527 passengers carried during 1919 and 982 passengers carried in 1920, we jump to 6,387 passengers carried during the first eight months of 1921. This last number comprising quite a large percentage of French passengers. This increase in the passenger service is due to an increased confidence of the public in the aerial service, which is quite justified by the rather low casualty lists which have been registered in the last 2½ years of operation, and also is due to the reduction of the transportation charge, which has been quite appreciable during the year 1921. In fact, over a total mileage of 1,685,000 miles flown from 1919 to September 1st, 1921, of which 57% was flown in the first eight months of 1921, only ten persons were killed and fourteen persons were wounded.

The reduction in transportation prices which took effect in 1921 was about in the order of 40% over the transportation charges of 1919 and 1920.

In table No. 9 are given the transportation charges per passenger, and per passenger per mile, over the various lines. These charges like any charges made by a company monopolizing a certain public service, are more or less arbitrary, the Government establishing a fixed maximum charge that the companies are allowed to charge to passengers travelling on their lines, and the companies themselves fixing the price somewhere below such a maximum. The subsidies paid by the French Government in 1921 to the operating companies, having been increased over the subsidies paid in the previous years, the companies have been able to reduce their charges to the public somewhat more in line with the corresponding transportation charges by rail and water.

The saving of time, effected by the use of aerial lines, is remarkable, but it is also remarkably less than it is fair to anticipate from the use of aeroplanes as carriers, this being due to the slow speed of the aeroplanes being used and to the fact that the conditions of the aeroplanes in service do not allow on the average more than about three hundred miles of non-stop flight. Dividing the distance from one end to the other of the line by the total time needed for completing the trip, (therefore, including time for stop-overs), the commercial velocity of operation over the line, Toulouse-Casablanca, (requiring 4 stop-overs and 1 night on the ground) is only of 37 miles per hour, which however, represents an actual saving in time of seventy hours, if the same trip were made by rail. The commercial speed of operation over the line, Paris-Bruxelles-Rotterdam and Amsterdam, figured in the same way, (requiring

two stop-overs) is 62 miles per hour and represents a saving of five hours over a railroad trip, also five hours are saved on the non stop-over flight between Paris and London, which is completed at a commercial speed of operation varying between 68 to 87 miles per hour. The commercial speed of operation over the line, Paris-Warsaw, which requires three stop-overs is in the order of 72 miles per hour and represents a saving in time of thirteen hours over the time taken for a railroad trip.

The Mail Service has also been considerably developed from 1919 to 1921 and the express service for the transportation of parcels, is also being considerably expanded. In fact, from table No. 1 we see that the total mail carried in 1919 was .44 tons and that was increased to 4.4 in 1920 and to 6 tons in the first eight months of 1921. These figures are an indication of the tendency of the service to increase in volume, they are as yet, very far below what is expected of them.

Tables, 4, 5, 6, 7, 8, 9 and 10 give the postal rates as established by law, in France from 1919 to 1921 and show a marked decrease in these rates in the last two years.

Various contracts have been made between the Post Office Department and the operating companies for the transportation of mail over the lines operated by them. Actually, the revenues accruing the Air Mail Service through the increased postal charge is left to the operating company by the Post Office Department under the form of a subsidy. The contracts made with the operating companies establish the conditions for the collecting of mail at the point of departure and the distribution at the point of arrival, the postal charge which may be required from the public, and defines the responsibility of the carrier and establishes penalties for failure in providing for the contracted services.

In these contracts all delays in delivering the mail due to the unavoidable delays in completing the trip are not chargeable to the company, which is not responsible for such delays.

All the correspondence is collected at the departure by the Post Office Bureau and is delivered to the Aerial Company about one hour before the departure of an aeroplane and is collected also by the Post Office Department at the arrival of the aeroplane. The operating company is directly responsible to the Post Office Department in the same way as the Post Office Department is responsible to the public. In case of accident, involving an unanticipated stop-over along the route, the mail must be transferred with the least possible delay to the nearest post office if the aeroplane is incapacitated to resume the trip within a reasonable time. The decreased postal charge for the Air Mail Service which went into effect last year has contributed toward the increase in the use of this means of new postal service on the part of the public.

The express matter carried by the operating air lines is handled through special agencies and delivery is generally made by these agencies to the specified address. The maximum dimensions allowed for express matter is 60 centimeters, by 40 cm. by 80 cm. (24 in. x 16 in. x 32 in.). One company set as a limit in weight 80 kilograms, (175 lbs.) The express rates are fixed on a weight basis, but for light and bulky parcels, 5,000 cubic centimeters (about 300 cubic inches) are taken as being equivalent to 1 kilogram in weight. The parcels can be insured, if so desired, but the insurance rates are rather prohibitive being as they are as high as about 15% of the declared value. The merchandise which has been trans-

(Continued on page 43)

THE WACO MODEL 4

THE latest product of The Weaver Aircraft Company of Lorain, Ohio, is a four place biplane, designed for commercial work by Clayton J. Brukner, and Elwood J. Junkin.

The primary thought in its conception is the great demand for a truly efficient plane powered with the reliable Curtiss Ox-5 motor. The result is a plane of remarkable performance characteristics, simplicity, strength and ease of control.

The designers had in mind the idea of presenting a machine which would possess weight carrying capabilities and maneuverability greatly in excess of any other product with the same motor and which would compare favorably with planes using much greater power. That such results have been attained is due to careful attention to all details and the correct coordination of accepted good

practice and the latest research. The entire machine is simple in construction which not only reduces the cost to the manufacturer and brings the selling price within the reach of the average flyer but greatly facilitates its operation and repair. It is unusually compact spreading only twenty-eight feet. This reduction of spread is directly ascribable to the employment of the U. S. A. 27 wing curve with its remarkable high lift and efficiency and is very acceptable since the reduction in housing space is appreciable. It is distinctly an advance in its ability to fly from and alight in fields inaccessible to the average plane now in use. The speed range is such that in flight the plane is at all times equal to any emergency and responsive to the controls yet the low landing speed and flat glide is not sacrificed for speed.

This plane has been put through exhaustive tests during the last two months and its excellent performance and maneuverability has evoked the admiration of a great number of pilots. Tests of the machine's speed show that with the motor turning a toothpick prop 1450 R. P. M. it is capable of a speed of 84 M.P.H. and that straight horizontal flight may be maintained throttled down to 1050 R. P. M., an important point when the life of the motor is considered. The climb with pilot alone is 850 feet per minute and with a full load of pilot and three passengers 480 feet per minute. On ordinary ground the average take-off was found to be 240 feet and the run on landing slightly less. In stunting the machine displayed remarkable alertness to control and confirmed the strength of sustaining and control surfaces. The factor of safety of

the beams of the upper and lower wings is 14 and in the fuselage and landing gear the safety factor at the weakest point is 10. The finish of the entire machine is excellent, the fuselage being a rich mahogany and the surfaces natural color.

Main Planes

The main cellule is comprised of four main planes and a center section panel. The spread is 28 feet with a 5 foot chord, staggered 10 inches. The dihedral is three degrees. The curve is the U. S. A. 27 a new high lift curve of thick section developed to meet the requirements of maximum efficiency and is of sufficient thickness to allow of strong, light beams. A noteworthy characteristic is the minimum translation of the center of pressure throughout the useful range of incidence angles which together with a decalage of two degrees is largely responsible for the stability displayed. The spars are of I beam section. The ribs are of the Pratt truss type, constructed with spruce battens and struts and gusseted with mahogany plywood. These ribs weigh only nine ounces yet are capable of withstanding a distributed load of over 500 pounds, a remarkable strength to weight ratio. The entering edge is plywood covered. The trailing edge is oval steel tubing. The internal drift bracing is with 8 ga. wire. All wood work is given two coats of waterproof varnish, metal parts two coats of durable enamel. The wing covers are made from Grade "A", government specification mercerized cotton and are finished with five coats of dope and three coats of clear Valspar varnish.

The cellule bracing consists of but one set of struts. The outboard struts are of spruce whereas the center section struts are of streamlined steel tubing. Fittings are stampings from nickel steel, enamel finish. Wires and turnbuckles are lacquered for preservation against weather. Four large ailerons are hinged to the rear spars employing a semi-closed gap. Aileron frames are spruce reinforced with mahogany plywood. Three hinges per aileron are used and a very simple and direct aileron control is used, employing streamline steel tube, inter-aileron struts. All control wires and pulleys are exposed and easy of inspection. Upper and lower panels are interchangeable.

Fuselage

The fuselage is of plywood construction throughout with the exception of the



Side view of the Weaver Aircraft Company's Model 4

motor compartment. Great care has been taken in securing an accessible motor mounting and it is possible to install or change motors without disconnecting any portion of the motor. The water pump and carburetor are especially accessible. The carburetor is provided with special air intakes outside the cowl and also a drain.

The gasoline feed is from an 18-gallon tank in the fuselage provided with a dash sight gage and a 20-gallon tank carried in the center section. A special shutter arrangement of the cowl doors is provided which controls the amount of air allowed to pass through the radiator and hence the temperature of the motor.

The fuselage is 36 inches wide at the passengers' compartment where three passengers are carried seated in clover leaf fashion. Ample leg and arm room is provided. The pilot's seat is very comfortable and his compartment roomy, yet his vision is not impaired, due to the shape of the cowl being such that he can see directly ahead along the side of the fuselage easier than in most ships with a narrower fuselage. The cockpit rims are padded and leather covered and leather seat cushions provided. The pilot's dashboard contains a complete set of flight

instruments, altimeter, air speed indicator etc. Dual control is provided, the controls in the front seat being easily disconnected. Ample baggage space is provided under the front seat and in the locker back of the pilot's seat. The front cockpit is provided with a large celluloid full width windshield and the pilot with an adjustable triplex glass shield. A special type of exhaust stack is provided which silences the motor to such an extent that it is possible for the passengers to carry on a conversation with ease.

Chassis

The chassis is the essence of strength and simplicity. This component is readily demountable as a unit, or individual parts may be disassembled with a minimum of inconvenience and disturbance of adjacent members. Practically all the parts are removable through the agency of quick detachable nickel steel lock pins of large diameter. The chassis is composed of two sets of substantial steel "V" struts of streamline section combined with a pair of steel spreader tubes attached at the apices of the paired struts, and an improved wheel and axle assembly. The whole unit is cross-braced with heavy cable and corresponding turnbuckles and



The Weaver Aircraft Company's Model 4 ready for a flight

fittings. The axle is of large diameter with a heavy wall reinforced at points of greatest load. The shock absorber cord is laced over and retained by belled aluminum spools of demountable construction. A feature of the chassis design is the fact that shock absorbers may be made up to length and then applied to the chassis. The wheels are 26" by 4".

A tail skid of conventional design protects the rear of the machine. It is mounted in a very novel and secure manner and operates semi-universally against the tension of the rubber coils. The skid is shod with a hardened steel shoe which is secured in place by bolts and is readily replaced when worn out.

Empennage

The tail unit consists of a moderately cambered fixed horizontal stabilizer of high aspect ratio to which are attached the single piece elevator, the fixed vertical fin and the rudder. The design of the empennage enables the units to be quickly assembled, the chief novelty being in the system of interlocking the various parts and the minimized fastening required to adequately support the surfaces to the

fuselage structure. The stabilizer is built up with spruce spars of liberal dimensions and spruce ribs suitably spaced and is drift braced with 8 ga. wire. The fin is of spruce and plywood construction and is unusually rigid. The frames of the rudder and elevator are made of steel tubing in conjunction with spruce ribs. Steel parts are joined by brazing. No welding operations whatever are employed in the construction of the machine. Elevator and rudder hinges are brass bushed steel straps and are of the closed gap type. Vanadium steel drop forged horns are used to actuate the rudder and elevator. The rudder is operated by cables which run direct to the foot bar through suitable fibre guides. The elevator is actuated by means of a steel tube from the control stick to the elevator control arm. All lost motion is eliminated and the control positive at all angles of elevator setting. The tail group is so secured to the fuselage that all drift, control thrust, and vertical loads are adequately provided for. The finish of the tail surfaces is identical with that of the main planes.

General Specifications

Span (both planes).....	28 ft.
Overall length.....	23 ft.
Chord (both planes).....	5 ft.
Gap	5 ft.
Stagger	10 in.
Area	265 sq. ft.
Aera Ailerons (4).....	36 sq. ft.
Area Rudder	11 sq. ft.
Area Elevator	19 sq. ft.
Area Stabilizer.....	25 sq. ft.
Aera Fin.....	2 sq. ft.
Weight, empty.....	1160 lbs.
Useful load.....	900 lbs.

Performance

Maximum speed.....	84 m.p.h.
Minimum speed.....	33 m.p.h.
Climb with full load.....	480 ft. per min.
Climb with pilot and two passengers	560 ft. per min.
Climb with pilot and one passenger	720 ft. per min.
Climb with pilot alone....	850 ft. per min.
Ceiling with pilot alone.....	19000 ft.

AIR MAIL SERVICE

Consolidated Statement of Performance From May 15, 1918, to Dec. 31, 1921

Month	Trips Possible (Scheduled)	Trips Attempted	Trips Defaulted	Trips Uncompleted	Weather Encountered		Mileage Possible (Scheduled)	Miles Traveled with Mail	Miles Ferry and Test	Total Miles Traveled	Percent of Performance	Mail Carried (lbs.)	Cost of Service	Forced Landings due to	
					Trips in Fog, etc.	Trips Clear								Mechanical	Other Causes
1918															
May (15 days).....	60	53	7	...	31	29	6,750	5,324	1,910	7,234	78.87	4,750	\$3,682.11	2	2
June.....	100	96	4	...	35	65	11,250	10,685	3,470	14,155	94.97	13,081	9,922.71	4	4
July.....	108	106	2	...	41	67	12,150	11,855	2,746	14,601	97.57	16,967	10,001.46	4	4
August.....	109	109	0	...	17	92	11,988	11,984	3,136	15,120	99.96	16,588	9,555.67	1	1
September.....	100	100	0	...	36	64	10,900	10,900	4,363	15,263	100.00	15,200	9,638.74	2	1
October.....	108	108	0	...	24	84	11,772	11,617	1,054	12,671	98.68	16,788	9,841.76	2	0
November.....	104	102	2	...	24	80	11,336	11,118	2,571	13,689	98.07	16,854	10,673.68	0	1
December.....	104	91	13	...	50	54	10,896	8,415	1,400	9,815	77.23	17,778	13,300.46	7	11
1919															
January.....	108	92	16	...	53	55	11,772	9,653	1,485	11,138	82.00	18,105	13,741.58	1	5
February.....	97	92	5	...	42	55	10,554	9,307	1,675	10,982	88.18	15,489	13,645.16	6	8
March.....	106	102	4	...	34	70	11,654	10,699	136	10,835	92.59	17,531	13,880.29	5	5
April.....	107	105	2	...	32	75	11,682	11,105	392	11,497	95.06	16,677	13,516.44	2	7
aMay.....	146	143	3	...	62	81	23,296	22,578	819	23,397	96.92	26,626½	17,715.66	3	9
June.....	160	160	0	...	46	114	30,943	30,835	15,143	45,978	99.65	35,647	30,891.62	4	4
bJuly.....	178	173	5	...	59	114	58,909	56,577	5,598	62,175	96.04	48,704	41,134.36	7	5
August.....	176	174	2	...	59	115	58,946	58,022	11,073	69,095	98.43	56,870	40,614.59	3	6
September.....	172	171½	½	...	40½	131	57,103	56,308	8,428	64,736	98.60	55,668	34,861.53	5	6
October.....	178	165	14	...	63	101	58,582	50,437	9,093	59,530	86.27	55,095	35,609.03	11	19
cNovember.....	177	172	11½	...	54½	82	48,214	41,757	8,848	50,605	86.61	54,084	31,127.58	6	14
December.....	156	125½	30½	...	58½	67	48,620	35,788	5,539	41,327	73.61	41,246	33,909.86	16	9
1920															
January.....	156	123½ (13½ ext ra)	46	...	39½	84	48,620	33,952	6,506	40,458	69.83	43,125	52,551.66	16	10
February.....	146	113½	32½	...	48	65½	45,970	32,647	5,511	38,158	71.02	37,242	46,004.12	4	1
cMarch.....	210	169	41	...	38	131	49,010	37,861	9,129	56,990	77.25	42,361	44,785.71	12	8
April.....	208	180	28	9	85	95	48,620	41,890	5,991	47,881	86.16	42,066	55,343.40	28	7
May.....	232	211	21	7	78	133	59,670	54,138	10,844	64,982	90.72	51,112	57,004.83	17	11
June.....	260	204	56	17	74	130	71,500	49,867	12,596	62,463	69.74	59,005	80,209.43	29	9
July.....	260	253	7	7	40	213	71,500	69,140	4,862	74,002	96.69	68,401	85,993.59	25	14
August.....	368	347	21	19	55	292	79,502	73,456	42,567	116,023	92.42	73,140	73,026.93	39	29
fSeptember.....	696	502	194	30	390	112	143,322	105,847	26,355	132,202	73.84	91,150	108,751.76	47	30
October.....	750	593	157	57	190	403	154,700	123,274	31,212	154,486	79.68	89,541½	123,618.68	54	59
November.....	758	575	183	77	230	345	156,076	114,750	25,009	139,759	73.50	87,302	121,501.18	85	69
December.....	884	662	222	105	347	315	178,776	127,306	3,734	131,040	71.21	89,942	131,205.96	89	138
1921															
January.....	850	697	153	87	253	444	171,900	132,679	6,930	139,609	77.18	84,435	136,488.61	117	131
February.....	782	660	122	71	310	350	159,238	130,431	13,224	143,655	81.90	88,135	131,855.43	82	122
March.....	918	871	47	59	351	520	185,652	171,593	15,032	186,625	92.42	110,117	152,442.27	64	123
April.....	884	837	47	36	370	467	178,776	171,156	15,794	186,950	95.73	117,778	147,890.64	79	107
gMay.....	850	833	17	20	320	513	171,900	168,397	12,819	181,216	97.96	115,073	125,754.74	72	81
hJune.....	832	829	3	10	268	561	168,636	166,956	18,135	185,091	99.00	105,838	127,479.83	57	51
July.....	624	623	1	6	65	558	131,450	130,555	18,129	148,684	99.31	77,276	109,799.11	34	29
August.....	693	689	4	13	129	560	136,974	134,549	14,883	149,432	98.22	84,680	106,986.98	32	30
September.....	657	651	6	8	180	471	127,706	125,914	22,185	148,099	98.59	88,401	102,998.45	13	26
October.....	714	707	7	7	166	541	140,080	138,759	20,212	158,971	99.05	99,057	122,205.51	23	21
November.....	672	633	39	46	285	348	131,520	117,529	25,616	143,145	89.36	93,519	117,417.83	17	74
December.....	726	660	66	37	266	394	142,240	125,416	15,840	141,256	88.17	101,198	118,264.70	42	46
TOTALS.....	16,684	15,076	1,642	728	5,439	9,640½	3,470,655	3,053,026	471,994	3,525,020	87.96	2,499,643	\$2,876,845.64	1,168	1,437

a Cleveland-Chicago route inaugurated May 15, 1919.

b Flight Washington to New York, prior to July reported as two trips account exchange of mails at Philadelphia, and subsequent to that date non-stop flight reported as one trip.

c New York-Cleveland service inaugurated July 1, 1919.

d November 9th, Sunday service on New York-Cleveland and Cleveland-Chicago routes discontinued.

e Flight New York to Cleveland considered two trips (i.e., New York-Bellefonte and Bellefonte-Cleveland) from March 1, 1920.

f Transcontinental service inaugurated September 8, 1920.

g May 31, 1921, last day's service on New York-Washington route.

h June 30, 1921, last day's service on St. Louis-Twin Cities Division.

i Temporary service from Elko to Ely, Nevada, inaugurated October 19th.

AERIAL TRANSPORT TODAY AND TOMORROW

By Lt. Col. W. A. BRISTOW, M. I. E. E., F. R. Ae. S.

(Concluded from page 14).

APPENDIX

This is not a technical paper and the author has endeavored as far as possible to abstain from dealing with matters that may form part of the subject of technical papers. It is desired, however, to draw attention to two matters which although of a technical nature have in addition a most important bearing on the commercial side of the business and which call for most serious attention. I allude firstly to the problem of getting aeroplanes into the air and landing them, and secondly to the many questions relating to the supply of fuel.

The first calls for very considerable research and experiment and the second for a clearer vision of the objects in view and more effective co-operation between the various parties concerned.

Getting-off and Landing.

An aeroplane in addition to operating in its normal medium must first haul itself up to its operating level, a process which is much more difficult than normal flying, and which necessitates a much less advantageous form of vehicle. Also, of course, on arriving at its destination, or even before, it has to retranslate itself to the earth.

It is as if a locomotive before commencing its journey had to haul the train out of a field and up a stiff gradient before it could get on to the rails and proceed on its journey. Imagine the seriously hampering effect such a state of things would have on train design and operating costs. Engines would have to be unnecessarily powerful, wheel loadings would need cutting down enormously, and the consequent cost per ton mile would be radically increased.

Trains, ships, motor carriages, trams, and all other forms of transport vehicle are in the happy state of being able to start, run and stop in their particular medium and on their special tracks. Even airships have this very great advantage, but heavier-than-air craft are inherently at a great disadvantage in this respect. With the ordinary type of wing in use to-day a loading of about 10 lbs. per sq. ft. is accepted as about the maximum possible, but if this difficulty of getting up and down again did not exist machines could operate quite safely with a wing loading of 20 lbs. to the sq. ft. or alternatively, if it were only a question of level flight, the power unit could be cut down to something like half its present output.

These twin operations of getting off and landing also account for nearly all the accidents that occur, and the high cost of insurance is entirely due to the dangers attending these operations. Here then is a problem that calls for the most urgent attention, its solution is vital to the progress of commercial aviation and also to the successful development of two very important classes of naval and military aircraft.

It is possible to help matters to some extent so far as getting-off is concerned by so designing the propeller that a greater proportion of the full power of the engine is available on the ground, and, which is also more effective, in producing thrust at the getting-off speed. During the war it was customary to design propellers such that in level full speed flight they prevented the engines being over-run, but it is a different matter today,—and in any case the more important problem of getting-off with full loads of passengers is one that calls for effective treatment, even if it does involve a slight disadvantage elsewhere. It is, of course, also better for the engines when on full throttle to run at speeds more closely approximating to the full load speeds for which they were designed.

The Petrol Position.

Let it be assumed that in the most efficient aeroplane existing a given load can be carried from London to Paris at a cost for petrol of 100 shillings. It will not be a very large load; that is immaterial. By improvements in design of the structure based upon long and painstaking work in the wind tunnel and full scale experiments we may succeed in another few years in so cutting down the resistance that our expenditure on petrol may drop to 80 shillings; in addition we may increase the working thermal efficiency of our engines by as much as 10 per cent. These improvements will reduce the cost of the petrol consumed on our hypothetical journey from 100 shillings to 72 shillings and represents what would be a very considerable over-all gain.

But if the price of petrol were reduced to 1/9d per gallon this 28 per cent saving could be effected to-day, and thus by a stroke of the pen the whole aviation industry could be

placed in the same position that otherwise will only be attained after years of effort.

I do not profess to know whether it is possible to make such a reduction in price; there are, of course, many who believe that the present level of petrol prices is artificially maintained, but I am very strongly of opinion that the question of a special price for petrol for commercial aviation should be most seriously considered.

Everybody connected with aerial transport has been making sacrifices of one sort or another in order that the business may be developed. The transport companies, their employees, aircraft and engine constructors, underwriters, the general public through the subsidy, in fact, it is difficult to point to a single interest of importance that has not contributed, and in many cases contributed heavily. As far as I know, however, the petrol companies themselves have made no similar sacrifices, but on the contrary have made a handsome profit out of the very large needs of an industry of supreme national importance struggling for its very existence.

I do not wish to do the companies any injustice; it may be that they make only a fair and reasonable profit on aviation spirit, but I do ask them to consider whether they cannot give a special rebate on petrol for commercial aviation for the next three years, even if it involves giving up their profit on this particular portion of their sales. If commercial aviation ultimately fades away the petrol companies will lose what would have been an exceptionally good market and will have themselves largely to blame for the loss.

It is not suggested for one moment that any such reduction in price is to take the place of improvements in machines and engines. It would be better for the price of petrol to go higher, rather than that designers should slacken their efforts, but with the cost of aerial transport at nearly £40 per ton there is urgent need for improvement and economy in every direction. Even to-day much can be done with a view to keeping down the consumption, not only that in actual flight, but also on the ground.

As this is a matter of very considerable importance it is proposed to examine this question in detail. In the first place it is essential that aircraft shall be fitted with accurate and easily read petrol gauges, or better still, with flowmeters in addition by which the consumption can be checked from point to point and at any moment.

A mere examination of the figures of over-all consumption is insufficient; it is essential to know how, when and where the fuel is being consumed at every stage of the operations. Having fitted suitable gauges which incidentally must indicate correctly both in the air and at rest with the tail skid on the ground, the next step is to inaugurate a petrol log book for each machine in which a complete stage to stage record is kept.

The first thing that will probably be observed is that the engines are using more in actual flight than would have been expected from a study of the test-bed consumption figures. Some of the causes of this cannot easily be remedied, but some economy can be effected. It will often be found the carburetors are at fault.

It is easy enough to set a carburetor on a test bench so that the mixture never errs in the slightest degree on the rich side but the engine is there always at one level, it is not bumped about, and even if it were occasionally starved somewhat on being opened out, it would not matter. But the ground engineer has a totally different proposition before him, and if the regulation of the mixture is in his hands he is always bound in the interests of safety to err on the rich side. It is not possible to tell, especially in daylight, how much the flow can be cut down, some engines give just the same revolutions on the ground with a mixture well on the rich side, and experience has shown that several engines of various nationalities have been consistently run on over-rich mixtures.

This also is partly due to the fact that at some period in the development of aero engines somebody invented the term "altitude control" for the fuel economiser. The result was that commercial pilots formed the idea that it was a device that did not interest them as they never flew at any altitude worth considering. As mechanics also did not look on it with favor owing to the difficulty in maintaining the correct clearance, it was taken off altogether or locked in some position supposed to correspond with full throttle requirements. For commercial machines it should have been termed the petrol economiser and every effort should have been made to induce pilots to use it to the uttermost capacity, instead of which we have

(Concluded on page 38).

AERIAL PHOTOGRAPHY

By W. L. HAMILTON

(Concluded from page 7).

The owner of a famous nursery at Amawalk-on-the-Hudson was able to secure in one photograph, a complete portrayal of all the species and foliage, actual number of the 350,000 trees and their height. It saved sending an agent on a tour of the premises to sell prospective purchasers. All the selling, practically, is now accomplished in the office, hundreds of yards from the rolling acres across which the staff formally trudged many weary miles daily. They now sell in the front office, or by canvassing with their photographic exhibits or through the medium of catalogues containing aerial views artistically arranged and printed. The possession of a set of these aerial views has enabled many salesmen to secure the attention of a prospective customer. He is interested in the remarkable photographs. His attention once held can be sustained.

Arthur S. Tuttle, Chief Engineer for the New York Board of Estimate and Apportionment, and credited with being one of the first city officials in the country to use aerial surveys for a practical purpose, found that their value is limitless both from the time-saving and economical points of view. He ordered a mosaic map from Fairchild in connection with the Narrows Tunnel project and marginal railway plan for the development of the New York Port.

The survey made from the air covered the proposed marginal railway territory, freight classifying yards and belt-line road connecting all the railroads terminating in New York. His principal objects were to put the plan most comprehensively before the railroad and other executives in the quickest possible period of time. One of the most interesting facts brought out was that the aerial map revealed the location of waterfront property on Staten Island, along Arthur Kill, close to New York, yet undeveloped; while on the opposite shore of Arthur Kill, in Jersey, the aerial view brought out distinctly the active industrial conditions there made possible by excellent rail facilities.

In showing his aerial map before the railway executives and engineers, Mr. Tuttle was able to demonstrate the feasibility of his railway plans in tying up transport with the new Staten Island piers. Also, he was able to make tentative charts of the routes to be taken, without a ground survey and months spent in securing information from the ground. By studying

the aerial map he was able to avoid residential sections, graveyards, highways and other obstructions which might otherwise have crept into his preliminary report of the proposed right of way.

Hotels have used aerial photographs in their advertising, showing patrons how centrally located they are in respect to other districts, such as the railroads, theatrical and shopping centers. Ports, Chambers of Commerce and suburban towns have benefited to remarkable extent by aerial advertising. The American Red Cross recently exhibited aerial views of New York's East Side, showing the lack of playgrounds and the congested tenement district. It was another way of telling the public how the foreign population lives. Scenes on the many square miles of flat-topped roofs remain a constant reminder of congested conditions which civic and charitable organizations are trying to remedy.

This accurate portrayal of built up sections and the wasted or uninhabited districts are matters for industrial and economic experts to consider. Not long ago a committee was appointed to ferret out the reasons why one side of a small stream in New York State was built up with factories and homes, while the other side had remained barren. It seemed a simple assignment, yet none of the reasons advanced was proof against the argument, until an aerial map of the entire territory was made. There it showed conclusively the trend of building and occupation had followed the railroad on that side of the stream. On the other there had been no railroad to provide the transport necessary to progressive industrial and civic development.

By far one of the main considerations of aerial photography is its saving in time and money. Securing a clear detailed vision, permanently, of areas under development, or plots damaged by fire, flood or storm, taking out timber or protecting that timber from forest fires, swamp drainage, excavating or municipal improvement, is economical. One or two cases in point may serve to illustrate this economy.

The Fairchild camera man left Curtiss Field, at Garden City, Long Island, N. Y., in a Curtiss standard plane. Over Port Washington he photographed the entire village; thence to Mamaroneck, N. Y., where Miss Merrill's School for Girls was photographed; over White Plains, completely pho-



An aerial photograph of a small section of Amawalk Nursery, showing mapping facilities backed up with the product in its natural form. In the foreground may be seen seedlings which give way in the background to trees of full growth measuring from 40 to 50 feet in height. This view is to be used on the back of the shipping card to show excellent shipping facilities backed up by the product itself, growing under ideal conditions

tographed; also Gedney Farms. On to North White Plains, where a view was made of the town; then to Kensico Dam, so large that ground photographers cannot get a complete view of it. The aerial picture gave it all including the surrounding hills and watersheds. On to Croton Dam, he duplicated the work there. Over to Valeria Homes where photos were made for engineering data and advertising displays, showing the plans for new buildings and building operations already under way; there also were taken views of the infested mosquito swamps and drainage system, giving in detail the enormous amount of work done, which incidentally gave a reason for the expenditure of the appropriations. The plane then went on to Peekskill where the Fleischmann Yeast Plant was taken; on down the Hudson Valley where a school was photographed, also John D. Rockefeller's estate, then the Sleepy Hollow Golf Course, Spuyten Duyvil, the United Electric Light and Power Company's Plant, the Bronx Concourse and finally the new electric plant on 133rd Street in the Bronx. In all 84 aerial photographs were taken during the flight—80 per cent of which were perfect and sold.

On another occasion Fairchild sent a camera man out of Port Washington in a plane and he made photographs of the Consolidated Gas Company's Plant at Astoria, L. I., Newton Creek Realty Corporation, showing details of property, its location relative to the Grand Central Station, the 59th Street Bridge and the broad highway leading through the property and over the East River right into the heart of New York. From there he went over the Austin Nichols Plant and made several close-up views for a special newspaper edition, the Drake Cake Factory, the Baker Shoe Factory, the Bliss Machine Tool Company, who wanted their their five buildings shown to best advantage for calendar purposes, the *S.S. Paris* departing from New York with Premier Briand aboard, and then over the Bay to Port Newark, which was photographed from high altitudes, thence to the William Shupe Lumber Company, which used the photographs to announce their removal from Orange to Newark on the Passaic River, and incidentally to show their proximity to New York City and the heart of Newark; thence over the city of Newark, where clear views of traffic, main streets, and residential sections were made (and later delivered), still on to the Submarine Boat Cor-

poration, showing New York and its harbor in the background, then down to the F. M. Taintor factory, where Paris White is made. The views taken over that plant showed the narrow gauge railway system, shipping facilities and magnitude of the plant itself, and were taken for the benefit of customers, to impress them with the substantial character of the Taintor works.

The views when completed actually bore out the assertion of H. E. Bessom, Editor of the *House and Trade Journal*, who said, "The ground view does not do justice, a wash drawing is usually unconvincing and is discounted; but that the aerial view pushes back the horizon, and one gets a different perspective with two sides and the top of all buildings, no matter what may be on the ground in front of them."

It is the forethought back of aerial photography, together with light and simple equipment made up in compact units, that has brought about the present successful development. It would require a visit to the aerial photo studio to present all of the problems and difficulties which numerous inventions have solved in recent months. With this kind of equipment the operator needs only to link up his aerial view with landmarks and other things that make the picture interesting—just as one would do in any successful photographic venture. To do this successfully is to find a ready market for aerial views. The factory which recently purchased views to reproduce on its shipping tags was following the line of least resistance in giving every person who saw the tag a conception of the size of the institution from where the goods were shipped.

This idea is being developed into another branch of the business. It has led to stocking prints, or to explain, saving prints of growing sections of city or country. By continuously taking photographs, say at regular intervals, one has a detailed history much easier to look at than musty diaries or old forgotten town hall records. This thought has penetrated the real estate business and offered it vast possibilities. The possibilities are as effective as the strength of the camera itself, which, due to the recent improvements, is now able to penetrate the thick blue haze which hangs over New York City almost continuously night and day; penetrate that haze, we repeat, and from high altitudes secure detail; for example, at 8,000 feet in the air in one single photograph fully 13 miles of the



Aerial photograph, the ultra modern method of portraying a factory and its shipping facilities, together with desirable residential quarters



A diagram showing how thirty-two square miles of New York was plotted and photographed in sixty-nine minutes with a modern aerial mapping camera. Above is a plan of the area. Below is a cross-section diagram showing the method of procedure

teeming metropolis lying like a toy city of building blocks under its mantle of blue.

There is another use for the aerial camera—the line map. Maps must be made wherever human beings would live and prosper, or traverse the trails once made over land and sea.

(Concluded from page 35).

machines getting-off with a mixture naturally on the rich side, even on the ground, and wasting at least ten per cent to fifteen per cent for the rest of the journey.

In my opinion the carburetor for commercial machines should contain two independent means of regulating the supply to the engine. The flow should be through a fixed jet of such capacity that the maximum requirements for getting-off are never prejudiced and an economiser under the control of the pilot added to the circuit in order that once safely in the air and well warmed up the petrol could be cut down to the minimum.

Further, the economiser should operate in such a manner that in the event of its becoming at all out of adjustment there would be no chance of the petrol supply becoming strangled. One means of effecting this would be by making the economiser work on the principle of reducing the pressure in the float chamber, so that if anything went wrong all that could happen would be a loss of economy until the fault was corrected, but with economisers of the needle valve type it is almost certain that sooner or later trouble will be experienced necessitating a forced landing.

It ought to be possible to-day to carry ten persons from London to Paris in still air on a single engine machine in two and a half hours on a consumption of about fifty gallons of good aviation petrol.

Another and a most important factor in the petrol situation is the wide variation in the quality of the petrol supplied by the various companies. This absolutely prevents any company from operating its engines at their maximum efficiency as in nearly every case they are compelled to work with a compression ratio below that at which their engines could be safely worked, and consequently with a serious loss in efficiency, and incidentally without that reserve of power they might otherwise possess. The remedy for this state of affairs is not easy, largely because on the London-Paris route supplies have to be drawn from different countries and the fuel is generally widely different in character.

The first requisite is a drastic revision of the basis on which petrol is sold. At the present time there seems to be a conspiracy of silence on the part of petrol companies as to the real value of their fuel for aero engines and most of the

The photographic mosaic, or aerial map, can be easily made into a line map by eliminating non-essential details, and it is being done wherever occasion requires.

Within the last few days Fairchild has completed arrangements with the Laurentide Air Service operating for the Laurentide Company of Grand Mere, Quebec, Canada, to plot and develop aerial photographs of 1,500 square miles of their timber holdings in the North country. From the aerial photographs, the foresters can count the number and tell the approximate size of the various kinds of trees. They can see burnt over, blown down, and cut over areas. They can literally do their lumber cruising in the office, quicker and at less expense than by the old method of sending timber cruising parties through the forest. The aerial photographs will be used as a check on the work done, to make sure that all cut timber is drawn out. With the photographs they will discover logs left on the banks of the river and they will be able to count and estimate the number of logs in the log booms. The aerial camera will find all these things and keep them on record permanently just as it found all of New York City and everything out of doors.

Aerial photography will increase in use and importance until it is an everyday part of routine business, just as ordinary photography is employed by every business and industrial institution today. This development will not only progress with the popularity of aviation. It will constitute one of the principal functions of the aeroplane. Not only will aerial mapping and other kinds of aerial photography come into general use among civilians but also with Governments. If it were to be used only for pioneer work, such as the preliminary surveying of the vast uncharted areas here, throughout the North American Continent, in all nations of South and Central America, the aerial camera would have steady and continuous employment for a score of years. Aviation authorities credit it with being one of the most progressive and profitable branches of aeronautics today and one which will develop with considerable rapidity.

Were one to visit the Fairchild Aerial Camera Corporation, he would understand the stability of an organization required to develop an efficient aerial camera and produce the many different kinds of photographs which highly specialized character require. Not only competent photographers and camera men must be trained in this branch of camera work, but paper lay-out, developing, machine operating and intelligent chemists, engineers and mechanics for laboratory work are included in the staff, each one of whom contributes his individual share in producing a picture of distinction.

official specifications for petrol are based on false premises and are entirely useless for all practical purposes. It would perhaps be the simplest course if engine makers published a table showing the maximum compressions that could be used with their engines, according to the different toluene values that could be guaranteed by the petrol supplier.

Thus, supposing a firm were using Lion engines, Messrs. Napier would provide a specification showing the maximum compression ratios possible with fuel of various toluene values giving consumption curves corresponding to the compressions indicated. The chief engineer of the transport company would decide the compression he would wish to adopt after consideration of the special circumstances of his particular service, and then proceed to place a contract for fuel according to the requisite toluene standard.


But, and a very important "but", the petrol companies would have to guarantee and actually maintain the standard agreed upon, otherwise there would be trouble of the most serious description.

It is believed that ten per cent to fifteen per cent could be saved immediately by effective co-operation between the various interests on these lines.

There are also minor ways of effecting economy. For instance, petrol can be saved by avoiding as far as possible taxiing machines under their own power. It is quite usual to see engines kept running for fifteen minutes after a machine arrives before taxiing away to the sheds. At Croydon the largest machine can be pushed by hand from the Customs House to the level crossing, although a tractor is necessary when coming in the opposite direction. The petrol that can be saved, however, under this heading is very considerable and runs into hundreds of gallons per month with very large machines.

There is also far too much petrol wasted tuning engines and warming them up before departure. A good ground engineer is worth paying well; if he thoroughly understands his engines and can test accurately and quickly he will save nearly £10 weekly on petrol alone.

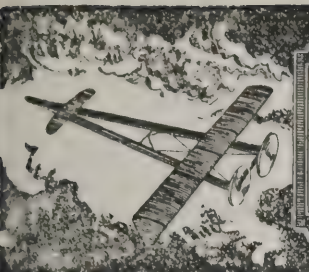
Economies such as are outlined in the foregoing may not appear of prime importance to-day, but it is fairly certain that they will all have to be effected to the utmost farthing before the balance sheet can show a profit without the subsidy.



ELEMENTARY AERONAUTICS

and

MODEL NOTES



Stability

AN aeroplane depends entirely upon its speed relative to the air for its support and direction. Therefore, if the aeroplane is to have a stability or steadiness—meaning by this, a tendency first to resist external forces acting to throw it out of its normal position in flight and, second, to return quickly to that position as soon as the disturbing force ceases—the forces operating upon the machine in normal flight must be balanced against each other. Of the four forces peculiar to the aeroplane two are vertical and two are horizontal. Of the vertical forces, *lift* (comprising both the wings, tail and body) exerts an upward force to the machine, and the *weight* tends to pull the machine downward. Of the horizontal forces, *drift* tends to hold the machine back and the *thrust* (of the propeller) exerts a forward pulling force.

These four forces must be balanced so that the total lift will equal the weight and the thrust equal the drift, in order for the machine to fly. The center of gravity of the machine should lie close to the other three forces and where it will be easier to balance them all properly.

It is essential for the center of gravity to be located slightly ahead of the center of lift so that when the power is off, removing the effect of the other forces, the location of the center of gravity will cause the machine to nose down and assume the proper gliding angle for safely descending.

It is on this account that designers locate the wings of a machine in a relation to the center of gravity in such a position that it will be ahead of the center of lift, and locate the center line of the thrust sufficiently far below the center of drift (or resistance) so that in flight it counteracts the normal tendency of the aeroplane to nose down, and all four forces completely balance each other, thus securing stability.

Kinds of Stability

The aeroplane must have stability in three directions, longitudinally, directionally and laterally.

Longitudinal stability means the balance fore and aft. In other words it refers to the stability of the aeroplane in the direction of its length and tends to keep it from pitching or trying to fly nose down or tail down.

Directional or "weather-cock" stability is the natural tendency of the aeroplane to remain head on to its course and prevents it from "yawing" or turning to right or left.

Lateral stability is the sideways balance of the machine, keeping it steady across the span and preventing it from "rolling" or "banking" in the air.

Longitudinal Stability

The first thing to remember in considering longitudinal stability is that while the centers of gravity, resistance and thrust remain in a fixed position, the center of lift changes its position as the angle of incidence of the wings is changed. For instance, consider an aeroplane balanced in a normal condition of flight and moving steadily along. Suppose a momentary gust of wind of considerable force strikes the aeroplane in such a manner that the nose is forced down. In this case the C. L. (center of lift) moves backward along the wing chord and unless some opposing force is supplied to bring it back into normal position again, the pull of gravity might easily overbalance the lift and bring the machine into a nose dive.

A large panel, usually of a somewhat semi-circular shape, known as the horizontal stabilizer is fastened flat on the top longerons at the tail in such a way that the wind meets it at a smaller angle of incidence than do the wings. When a downward wind on the nose sends the tail up, a restoring force is at once supplied through the resistance of the air to the stabilizer's upward movement and this force, though small in itself, acts at the end of such a long lever arm that it is sufficient to push the tail end down and restore a condition of equilibrium. In precisely the same way the reaction on the stabilizer acts to life the tail up when it is turned at an angle due to the nose being lifted.

Longitudinal stability for an aeroplane is therefore a question of a large enough stabilizer set parallel to the line of thrust on a well balanced machine.

In determining the size and setting of the stabilizer, consideration must be given to the fact that the stabilizer acts in the "wash" of the wing panels, and that this air-wash has a downward slant towards the tail. In order that the wash be deflected upward from the tail, it is sometimes necessary to give the stabilizer a slight upward curve on its top surface.

Directional Stability

Directional stability is secured by having all the parts of the aeroplane which contribute to its total keel surface of the proper size and correct position. By keel surface is meant everything seen from the side of the aeroplane—fuselage side, struts, landing gear, wing ends, fin and rudder, etc.

If the aeroplane is to promptly resume its original direction after being momentarily diverted from it by a side gust of wind, there must be more of this keel surface behind the center of gravity than in front of it. Of course there must be as much keel surface on one side of the longitudinal axis as on the other, to avoid having the plane swing from side to side.

The size and location of the fin (or vertical stabilizer) finally decides the directional stability. The fin is usually a flat triangular panel located on top of the horizontal stabilizer, at right angles to it, and is "edge-on" to the air stream when the aeroplane is in normal flight. The slightest deviation from the straight course of the aeroplane (relative to the air; not relative to the earth) causes the force of the air stream to be felt on the side of the fin, and this force acting as on a long lever arm (the fuselage) is sufficient to swing the nose of the plane head on to the wind once more.

Lateral Stability

When one wing is tipped downward, the center of lift is thrown to one side and out of line with the center of gravity. So the resulting influence of lift and gravity then causes the aeroplane to roll over sideways and downward. To correct this influence, the wings are usually set with a "dihedral" angle—that is, with the wing panels inclined slightly upward from the center. With such a setting, when the machine is tipped over on one wing, the wing on the lower side presents more lifting surface, while the lift on the high wing decreases. Thus the tendency is for the low wing to rise and the high wing to drop, restoring again the lateral stability of the machine.

Controls

Longitudinal control is obtained by means of elevators, or horizontal surfaces (usually two, acting together in the same direction) hinged at the rear of the rudder.

Directional control is by means of a vertical rudder hinged to the vertical stabilizer.

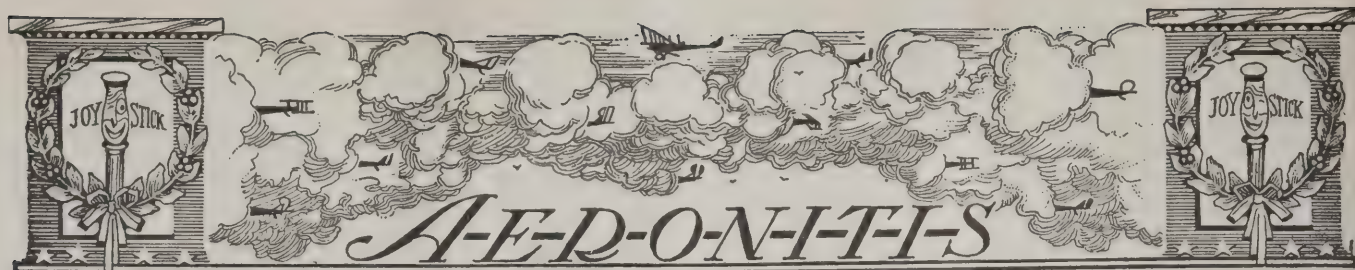
Lateral control is attained by double acting "ailerons" at the rear of the wings, near the ends, one arranged to lift one wing while the other depresses the opposite wing, and vice versa.

Boy's First Model Proves Successful

A Lawrence Military tractor scale flying model built by Edwin Bockhold of McDonald, Kansas, proved to fly well, getting off the ground in a run of about four feet. This is the first model he has ever built. It has a wing span of 36 inches. Covering is with Japanese silk. Complete, the model weighs eight and seventy-five-hundredths ounces (8.75).

Wolves Hunted by Aeroplane

Mr. Bockhold tells of an interesting event in his part of the country. He says that people in that section are getting more interested in aviation. A "wolf hunt" was staged at McDonald recently. A Doctor Brewster of Beaver City, Nebraska, (about 75 miles from McDonald, Kansas) used two of his planes to spot the wolves from the air, and to signal to the men on the ground to keep them in line. This novel way of hunting wolves was a very efficient one and opens the way to further uses of aircraft in combating destructive animals on a large scale.



Flying Tips

A few little tips to your boys who fly,
Before you start, and when you're in the sky.

My experience taught me a few

And I will try to explain them to you.

Be careful and fly a very good plane

To use a poor one is never sane;

Many a good pilot, who did some stunts,

Found out too late that he was taking a chance,

Something will go wrong before you can land,

And you will come down fast, hitting the sand.

The rear part of the fuselage is known as the tail,
Always make sure it is sturdy, not frail.

This tail and controls were in front one time,
The Wright Brothers thought they were doing fine.

Then Curtiss came, and when flying one day

A bird used his tail to get out of the way—

And he realized that, with the tail in front,

He wouldn't have been able to do this stunt;

So he went by and put it as we know

Where the birds have their tails—it is better so.

Now to fly, you need a mechanic,

If good, he can save many a panic.

Little details leave to him to get ready,

Always be sure that your nerves are steady,

And when you're ready for exhibition,

Your clothes must fit and cause admiration.

Girls will look as to the plane you ramble,

And whisper nice things—that, you can gamble.

When inspecting the plane always look wise

Everything must be right when you rise.

If you don't know how, make it a good bluff,

Then people will think that you know your stuff.

Be sure your nerves don't leave while inspecting,

Or the throng will have fun in suspecting.

Under the wheels place blocks, so ship won't run away

While you test your motor out at full sway.

Next get on board, and if you think it hard,

Think of a Pullman berth, which is as bad.

Without kicking holes in the linen part,

You'll soon be ready now for the start.

Be sure to strap yourself in the seat

With the rudder bar just touching the feet.

Then make sure that everyone stands clear

Back from the ship and the propeller's lair.

When you call: "Contact," and push down on the switch,

Your mechanic will give the propeller a hitch.

If the motor will not instantly take,

Think of Henry, and products of his make.

Don't get impatient the first thing, boys,

The motor will start with a lot of noise.

If started you will see a dizzy prop,

Give her the gas slowly, or she will choke and stop.

When warm, give her the gun, all she can stand,

To turn up enough "revs"—it surely feels grand.

Now find if the motor to throttle replies—

It will mean a lot, when riding the skies.

Next, move your control stick from left to right,

And find if controls will respond at sight,

This is to be known as the "joystick test,"

So we wiggle it the same as the rest.

The blocks are removed, you are ready to try,

If you can, into the wind you must fly.

Now give her the gas—all she can stand,

Pressing the joystick forward with one hand.

The tail raises and enough speed is found;

You come back with stick, so leaving the ground.

When you're in the air you must practise next

To fly straight is the aviators text.

Parallel with horizon the wings must keep,

Don't climb too much, never turn too steep.

A stall will result if you climb too much,

And you will land with a need for a crutch,

If the left wing dips bring stick to the right,

If the right dips, bring stick to left side.

If the tail dips, push forward without fear,

And if the nose dips pull the stick to the rear.

If everything dips it's good to know

A childhood prayer—it is better so.

Don't mind a mistake—it will go all right;

Make a turn now, and keep the field in sight.

When nearing the field get ready to land,

Don't hold the stick too tightly in your hand.

Throttle the motor, while nosing down the ship,

Don't dive too steeply at too lively a clip!

While nearing the ground head into the breeze,

Bring stick back slowly and speed will decrease.

If you come down in a long, even glide,

The plane will touch ground and evenly ride.

Good pilots touch ground without any force,

While poor ones hit hard, and do even worse.

As you don't get hurt while in the air,

Be careful how you land, do not show fear.

In landing poor, get out the best you can,

Blame something, keep yourself out of the pan.

After landing you'll need one of two bets—

Medical attention, or cigarettes.

If landing is good get up enough speed,

With lots of noise toward the crowd proceed.

Then stop the motor and get out of your seat,

Take care of the linen and watch your feet.

Then questions will come how it is above,

Like "how big the town looks," or "Cutchie's Grove."

If you don't answer all you're a beaut,

You don't have to stick closely to the truth.

They always like to question you

And think you're an Information Bureau.

To get away it is no use to try,

To satisfy them all you will have to lie.

Just say for "only" fifteen iron beans

You will take them up to look at the scenes.

Just a few more words before I quit,

Carry with you something like a tool kit,

Also make sure of plenty of gas and oil,

It sure comes handy and don't last to spoil.

Then linen and thread and a can of dope,

A motor cover and a towel with soap.

So long now, boys, next week look me over

In my new poem, "The Aerial Rover."

You will like it almost as much as I do,

For it is exciting and almost true.

B. K. R.

The Wings of Mars

A genius tied a thought to his kite,

And it sailed above the stars;

He pulled it back to earth again,

And when the grim god Mars

Had armed himself, and bent his bow,

To let his arrows fly,

This thought had grown, and Mars perceived,

And so he wondered why:—

If weapons are the tools of war,

And death the work at hand—

He should not use of every means,

On ocean, air and land.

Thus, while the grey ships sailed the deep,

And death rode on the waves;

The great guns bellowed on the earth,

And filled the heroes' graves.

But high above—among the stars—

A shadow hovered there;

And death rained down in silent hate,

From dread ships of the air.

Lawder.

(Continued from page 32).

ported over French lines in this brief period of operation have mostly been expensive material, like clothes, furs, millinery, clocks, jewelry, paintings, films, and choice perishable foods, such as seasonable fruits, etc. It would be interesting to know the value of the merchandise which has been carried as express matter by the aerial operating companies in France, but these figures not being available, we can surmise it knowing that on the approximate value of a large percentage of 112 tons of express matter carried during the year 1921, 560,000 francs were paid for customs duty at the aero-port of Bourget, (Paris); where the traffic between France and England, Belgium, Holland and Hungary converges. This figure does not include any customs duty which might have been paid in connection with the traffic between France and Spain.

Due to the geographical and political importance of the city of Paris, the French capital is the center of operation of all French railroads, and therefore the Bourget aero-port which is really the aero-port of the city of Paris is bound to be the most important center of commercial aviation in France, from which almost all aerial lines radiate like the spokes of a wheel.

The total number of passengers carried by French and other aerial lines passing through the Bourget aero-port from May 1, to October 31, 1921 was 10,994. In the same period of time 97 tons of express material and 5100 lbs. of mail were handled at Bourget.

Table No. 2 gives the figures for each month in the above period of time.

Table No. 3 shows a comparison between the number of passengers, aeroplanes, tons of express matter, and pounds of mail handled through the Bourget aero-port during September and October, 1920 and during September and October 1921 respectively. The increase in the service as resulting from the comparison of these figures shows a noticeable progress.

Cost of Operation

As mentioned before, the cost of operation of commercial aerial lines in France, due to various reasons, has not been a success by any means, and though conditions are continuously improving, the progress made is hardly in proportion with the heavy expenditures made by the Government under the form of subsidies and by privately owned capital invested in the operation of these lines. Much more satisfactory results might have been achieved if there had been a more ready response on the part of the public in patronizing the aerial lines and on the part of the capitalists in investing sufficient money in these companies as to allow the building of better aircraft and in general a more economical utilization of the present lines. The operating companies as organized at present are made up of groups of aircraft manufacturers, manufacturers of aircraft material and privately owned capital obtained through the sale of stock of the operating companies.

As can be seen by the figures given in Table No. 1, the estimated total revenues of the operating companies was about 45,000 francs in 1919, 720,000 francs in 1920 and 2,400,000 francs in the first eight months of 1921. The revenues of these companies per mile flown varied from .225 to 1.37 and to 2.5 francs in 1919, 1920, and 1921 respectively, which is far below the actual cost of operation, which according to an estimate made by Breguet, taking as a basis the service between Paris and Londres only, is in the order of 14.5 francs per mile flown. The total declared capitalization of all the operating companies was, at the end of 1921, 25 millions of francs.

The continuation of the operation of these lines has been rendered possible through the heavy subsidies paid by the Government, in order to facilitate and to encourage the establishment and the development of commercial aerial lines in France. The undersecretariate of aeronautics in France has obtained from Parliament sufficient funds to allow payments of subsidies to specially important companies during the next ten years. This law was passed on July 31, 1920. This legislation will undoubtedly greatly help in the development of commercial aviation in France, allowing as it does to spread over a period of ten years, the losses which were incurred so far. As an indication of the costs of operation of aerial lines in France, the following figures furnished by Breguet, based on the cost of operation of Breguet 350 h.p. aeroplanes operating between Paris and London, may be taken as a fair average:

Fuel 2.50 francs per mile; Oil .40 francs per mile; 1 pilot .65 per mile; depreciation of flying equipment 3.25 francs per mile; repair of aircraft and aircraft material 2.90 francs per mile; cost of hangar and transportation of passengers by automobile from Paris to Bourget .8 francs per mile; overhead expenses 4. francs per mile; making a total of 14.55 francs per mile. With the type of aeroplane used by Breguet at

the present time having a carrying capacity of half a ton only of commercial load, the cost of the ton mile is 29 francs. Actually the cost of the ton mile is noticeably higher due to the fact that on the average airplanes are travelling only half loaded. These figures are rather high, but it is anticipated by Breguet that inside of the next two years, the cost of operation per mile can be brought down to 8 francs by using aeroplanes best adapted to the kind of service required of them.

It might be interesting to know that an aeroplane is now being designed by Breguet, having a total h.p. of 2,000; carrying surface 2,500 sq. ft, total load 14 tons, commercial speed 124 miles per hour, capable of making a non-stop flight with a full load on board of between 1550 to 1850 miles with 20 passengers supplied with the desired comforts on board, and a crew of 7 men to man the ship. It is estimated by Breguet that the cost of the aeroplane after the design has been perfected and the first one or two aeroplanes have been thoroughly tested, is going to be 1,000,000 francs, which is going to be spread over 1,000 hours of flying. The cost of operation per ton-mile is figured to be 12 francs. Figuring on 200 pounds weight per passenger and his baggage, the cost of operation per passenger per mile has been calculated to be 1.20 francs.

To go from Paris to Buenos Aires, South America, the charge on steamship lines for first class cabin is 15,200 francs and the trip is made in twenty days. The Breguet aeroplane now being constructed, starting at 1 P.M. on Saturday from Paris can reach Buenos Aires in two days and nineteen hours, after making stops of one hour at Casablanca, Dakar, two hours at Rio de Janeiro. The cost of the trip to the operating companies, taking as a basis the figure 1.20 francs per passenger per mile, is equal to 9,000 francs as compared to 15,200 francs which is charged by the steamship company making the same trip in 20 days.

A second route which has been laid out by the Breguet Company in the Far East is Constantinople, Bagdad, Bombay, Calcutta, Hanoi, Shanghai, Yokohama, a distance of 9,250 miles which can be covered with the Giant Breguet aeroplane in four days. The cost to the operating company per passenger, figured on the same basis as stated before is 11,000 francs. To make the same trip by rail and water, it costs 12,000 francs and it takes 42 days. The price of 1,000,000 francs calculated by Breguet for building this giant aeroplane is not the price which the first aeroplane, now being designed, is going to cost, but it is the price which it shall cost to build other aeroplanes in the future after this first one has been built, tested, modified and made absolutely fool-proof.

It is calculated that 6,000,000 of francs will be spent by the Breguet firm for developing this new type of aircraft, with the expectation of operating it between Paris and Buenos Aires and Paris-Yokohama.

Insurance

With the birth of aerial navigation, the insurance to cover the risks of this new means of transportation has become necessary. It is too early as yet to have any statistics on this matter but we can survey what is being done at the present time by insurance companies. The most of the insurance companies in France grouped together in 1919 for carrying in common the risks of aviation. French insurance policies, in principle, insure the navigating personnel on the basis of 15% of their salaries for single men and 25% of their salaries for married men. The tariffs of some of the companies vary between 20% to 22½% depending on the kind of licenses held by the pilot. Insurance rates for the ground personnel are 3 to 4% of their pay. Due to accidents on the line Paris-Londres in the last two years, liabilities paid by the insurance companies have been more than 3,000,000 francs. The premiums collected by insurance companies in the same period have been about 2,000,000 francs. This is the reason why at the present time most of the insurance companies do not write any more insurance policies for the flying personnel of aerial companies.

The rates for the insurance of aircraft are very high and for this reason not all the aircraft in operation are insured. If aircraft manufacturers, and aerial navigating companies all took insurance on their flying material and the lives of their personnel, the insurance rates would be brought down to more reasonable figures. French aerial operating companies are favored by the Government in the insurance game, because the Government pays one third of the insurance premiums paid by the companies for insuring their personnel and their material. This of course, applies only to those companies which are subsidized by the Government. For the insurance of passengers, the rates charged are about 10% of the premium payable in case of death for each trip.

At the present time, the aerial operating companies to cover themselves against suits, which might be started against them

(Continued on page 46).

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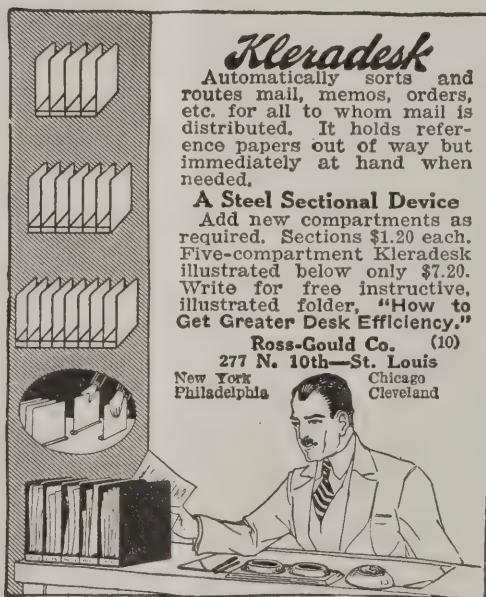
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(Continued from page 43).

by passengrs or their survivors in case of accident, have their choice between two insurance policies. They can either pay 10% of the price of the passage or 500 francs per year and per passenger seat available on all their aeroplanes carrying pas- sengers. The maximum liabilities of the insurance company in consideration of the payment of these premiums cannot ex- ceed 100,000 francs per passenger transported by the company.

The insurance for merchandise is much cheaper than the insurance for personnel and flying material. The rates charged are 2.50% of the declared value on the line of Paris- Amsterdam, 6% on the line Paris-Prague, 10.50% on the Paris-Warsaw, 3% on the Bayonne-Bilbao, 10% on the Tou- louse-Casablanca and 2.50% on the Toulouse-Bordeaux.

Conclusion:

As we have seen before, the French Government seems to take a very lively interest in the establishment and develop- ment on a large scale of commercial aviation along interna- tional lines. Political expediency and a clear vision of the future commercial advantages to be gained, coupled with the military advantages accruing in case of war by the possibi- lities to requisition and to operate for military purposes, the flying equipment and the ground organization of aerial com- panies, are important factors in this matter.

The Aero Club of France is also contributing a good deal to the development of aeronautics in France, as is evidenced by the numerous aeronautical events which have taken place in France since the war. Besides, however, being an im- portant medium through which air races and exhibitions are organized in France, the Aero Club contributes also a good deal to the development of aircraft and power plant develop- ments by awarding prizes to the best products of the French aircraft manufacturing industry, built according to specifica- tions. Mr. Michelin, who until recently was President of the Aero Club, has been a very generous patron of aeronautics and has given freely, money for promoting the development of the French aircraft manufacturing industry. The present President of the Aero Club, Mr. Flandin, who was until re- cently the undersecretary of aeronautics in France, has taken Mr. Michelin's place, and he will no doubt further extend the activities of the Aero Club.

Last year, a "French committee for Aeronautical propo- ganda," was established in France mainly due to Mr. Michelin.

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This committee which is presided over by General Duval, who up to 1920 was the Chief of the "organ of coordination of aeronautics and aerial transports" (which as we said before, was superseded in 1920 by the creation of an undersecretariate of aeronautics) has recently offered a prize of 1,000,000 francs for an aerial engine possessing the requisite characteristics for safe and economical operation required for commercial ser- vice. The time limit for entering such an aerial engine into the competition is June 1, 1923. The money for this prize was supplied by Mr. Michelin.

The close ties existing between France, England, and Bel- gium, on civil aviation policies, as it is evidenced by the peri- odical conferences which are held between the French, English and Belgian departments of civil aviation, and the French supremacy in Poland and in the nations of the Little Entente, greatly point to the intention of the French Government to have French civil aviation be an important factor in conti- nental Europe.

The factors which contributed so far to make aviation an unsuccessful financial undertaking are due to lack of expe- rience in this new type of transportation service, are due to the flying equipment used and are also due to the lack of interest on the part of the public and to the high rates charged for this service. These are being gradually elimi- nated and the Government has done a good pioneer work in allowing the present aerial lines to operate at a loss, and by providing a good ground organization and a well organized meteorological and wireless service, which are essential to the successful operation of aerial lines.

I think it is safe to predict that although the Germans after May 5, of this year will enter very keenly in the competition for civil aviation services in Europe, France has a good start on them.

The French Air Budget for 1922, as passed by Parliament, totals approximately 436 million francs. The main appro- priations are: Minister of War: For Home Squadrons, 214,- 287,500 francs; Algeria and Tunis 9,936,490 francs; Morocco, 22,173,092 francs; total 246,397,082 francs. Under Secretary of State Department for Aeronautics, 147,219,970 francs, which includes foreign air attaches, 200,000 francs; technical service, 5,400,000 francs; prizes and subsidies for commercial aviation, 45,382,000 francs. Ministry of Marine, 37,318,543 francs; Ministry of Colonies, 4,991,000 francs.

(To be continued).

AERIAL AGE

WEEKLY

VOL. 15, No. 3

MARCH 27, 1922

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Airscape of Denver's Civic Center and Business District

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Urges National Airway System for the United
States — A New Gas for Airships —
From Jungleland into Skyland

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March 27, 1922



Vol. XV, No. 3

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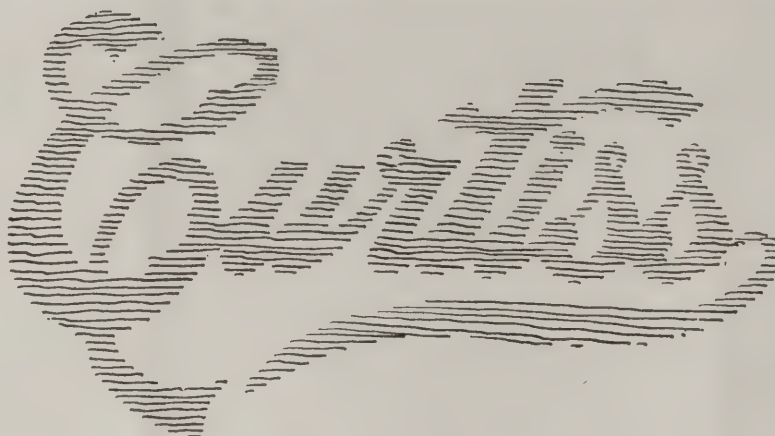
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OX5 As received from Government.....	500.00 F.O.B. Various concentration fields

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VOL. XV

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No. 3

Urges National Airway System for the United States

BRIGADIER-GENERAL WILLIAM MITCHELL, assistant chief of the Air Service, recently returned from Europe, where he made a very comprehensive survey of aerial activities. In a statement issued at the offices of the Aeronautical Chamber of Commerce he urged the establishment of a system of national airways in the United States. He said, in part:

"Europe is making great strides in the development of aviation, but in its actual application, as illustrated by the bombing manoeuvres last summer, we are in the lead. What the United States needs is an organized system of airways, Federal laws and some form of tangible encouragement for its civilian operators. Some 12 or 15 aircraft lines are in operation in England, France, Holland, Belgium and Italy. The air port of London (Croydon) and Paris (Le Bourget) are well organized and systematically conducted, with customs houses, hotels and means of communication with the city. People in Europe are patronizing the air lines as a utility. During the month of February about 1,400 passengers were cleared at the Paris Air Port. The French are running the longest lines—Paris to Bucharest, with an extension to Constantinople. In all the larger European nations aviation is being developed with the idea that it is the first line of defense, and subsidies of 50 per cent. or so on the original cost and the cost of operation are in effect for privately owned aircraft.

"There is no visible aviation in Germany, but they are doing great things there. The gliding flights are evolving types with motors of only 5 h.p., which means a very cheap ship.

"The French intend and the Germans expect to fly the Atlantic. Airships have not been scrapped, but are sure to be the long distance carriers. The German-Spanish-Argentine Zeppelin line between Seville and Buenos Aires is going through."

General Mitchell flew in every country visited, personally testing out some fifteen new types of aircraft, again demonstrating that the affairs of the Army Air Service are in good hands, for General Patrick and General Mitchell are both practical and efficient aeronautic enthusiasts.

Modern Forest Fire Fighting

WE have editorially urged on more than one occasion the greater utilization of aircraft for forest fire patrol, and we are glad to have the following comment from Paul G. Redington, district forester at San Francisco:

"Special flights over and around large fires to get a comprehensive view of the situation are of inestimable value. Very often we have fires in such rough and inaccessible country that it would take a day or even more for the man in charge to get around them, size up the situation and determine his plan of attack. Of course in the meantime the situation might entirely change, and he would be little better off than when he started. If, however, he makes use of a plane he can, in an hour or less, get an accurate picture of the fire, and can immediately so dispose of his forces as to attack it most effectively. Such flights should of course be made with the man in charge of the fire or an experienced fire fighter as observer, since a great deal will depend upon his personal judgment. If desired, an emergency radio station can be established on the fire line and direct communication may be had from the plane to the ground. All pilots are radio operators, so that if the forest officer who is flying as observer is not qualified in this respect he can write out the messages and hand them to the pilot for sending. However, even if no radio is used there is very little delay in the dispatching of the information gained, since a plane traveling at ninety miles an hour will return to a landing field in a few minutes, and the observer can then report by phone or in person."

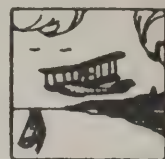
A New Gas for Airships

CURRENIUM is the name given a new gas for airships, which has been developed by Dr. Edward Curran, head of the research department of the International Transportation and Manufacturing Company, of Los Angeles, which controls the formula and all rights in the product. It is the result of several years' work by Dr. Curran, who is a chemist, and who produced the gas successfully in 1918. The company owning the formula is preparing to engage in the manufacture of the gas, by an electrolytic process at a cost, it is estimated, about \$100.00 per thousand cubic feet less than it costs to produce helium.

We expect to present to our readers next week more comprehensive information concerning this important new development in the lighter-than-air field.



THE NEWS OF THE WEEK



A. C. C. Elects Officers

The Board of Governors of the Aeronautical Chamber of Commerce of America, Inc., at a meeting at the executive offices, 501 Fifth Avenue, New York City, March 15th, elected the following officers:

President, Grover C. Loening, president of the Loening Aeronautical Engineering Co.

First Vice-President, Charles F. Redden, president Aeromarine Airways, Inc.

Second Vice-President, C. C. Witmer, president Airship Manufacturing Company of America.

Treasurer, B. E. Bushnell, Director of Sales, Stewart Hartshorn Company.

Secretary and General Manager, S. S. Bradley, Manufacturers Aircraft Association, Inc.

Assistant Secretary and Assistant Treasurer, Luther K. Bell.

9000 Mile Flying Boat Trip

With 9000 miles ahead of it, an Aeromarine navy six passenger flying boat with three men on board, took off March 15 on the Hudson River off Eighty-second Street.

P. Ewing Easter, head of the Easter Airways of Baltimore, piloted the boat, and Charles E. Haynes, engineer, and Lyman I. Collins, passenger traffic manager, went as passengers. Mr. Easter plans to fly in his new ship down the Atlantic coast to Key West, thence to Havana, to New Orleans, up the Mississippi to St. Louis, along the Ohio to Pittsburgh, then back and up the Mississippi to the Great Lakes and down the Hudson to New York, going then to Baltimore. On the way the flying boat will carry passengers at various cities.

No attempt will be made for speed. The first stop was at the aeromarine plant at Keyport, N. J.

General Air Service Secures German Patents

Johann Schuette, president of the Schuette-Lanz Airship Company of Germany, left Washington, D. C. for Germany, where he will complete an organization to serve as a nucleus for building airships for the General Air Service, a recently incorporated aerial transport company with headquarters in New York.

"Contracts giving to the General Air Service the manufacturers' right and patent interest of the Schuette-Lanz rigid airships for the world have been signed," Dr. Schuette said, stating that it was the most important act of his life, as he considered it the founding of a new industry in America which would insure to the United States the premier position in aeronautics in the world.

The General Air Service, which was incorporated for \$50,000,000 under the laws of Maryland, plans to start a service with two large passenger carrying and express airships between New York and Chicago, from which points the service will gradually be extended to the Pacific coast and eventually to South America and Europe.

American Fliers Win Concessions in Brazil

The Brazilian Government has awarded to American aviators Orton and Hoover aeroplane concessions or the forthcoming centenary exposition.

Amundsen Buys Plane for North Pole Quest

Seattle—Capt. Roald Amundsen, the discoverer of the South Pole, has purchased a nine passenger aeroplane to be used in scientific expeditions in connection with his forthcoming attempt to drift past the North Pole with the Arctic ice pack, H. H. Hammer, his agent, announced March 15.

Capt. Amundsen, who is in Norway on business connected with the expedition, will return to New York March 28, accompanied by a Norwegian army aviator. The aviator, with another to be picked up in New York, will fly the plane to Seattle under present plans, Mr. Hammer said.

The explorer plans to resume in May his Arctic voyage interrupted last year when his ship, the Maud, dropped a propper off the northwestern Siberian coast.

American Airways Reorganized

The American Airways has now been incorporated under the laws of the State of New York. The purpose of the company remains the same, to build, sell and trade in aircraft, to conduct a training school for aeroplane mechanics and pilots, and to operate passenger-carrying ships.

The officers of the company are: Hugh D. McKay, president; Robert H. Blumensstock, vice-president and treasurer; Arthur Johns, secretary; Augustus Post, director, and Robert A. Franks, director. There are about twenty-five men at the school now, and the instructional staff consists of: Theodore L. Tibbs, chief pilot and head instructor; George Stelz, former owner College Point Boat Corp., construction; Antony Bragoz, formerly fifteen years in Italy with Fiat, chief of motors; Henry Meyers, formerly of L. W. F., chief of wing work; John Sperry, Jr., mathematics, designing and motors; Charles Reinhardt, formerly of Aero, Ltd., is passenger agent at Ritz-Carlton Hotel, and Scott Paton, formerly of Royal Air Force, maintains an office at Hotel Lorraine; Leslie Gillette, formerly R. F. C., is on the selling staff. The Navy and Army have just designed the American Airways base at College Point as an authorized seadrome and it has been officially listed as such.

Dusting Trees From an Aeroplane

The use of the aeroplane in entomological work is no novelty, since it has been frequently employed in both the United States and Canada in locating areas in forest lands, where injurious insects have been at work. Messrs. J. S. Houser and C. R. Neillie, of Ohio, however, tell of a new use to which aeroplanes have been put, viz., that of applying insecticides to the tops of trees.

In a paper read before the Association of Economic Entomologists at Toronto city, these gentlemen described an experiment made at Troy by the Federal Air Service, co-operating with the Ohio Experiment Station and the Department of Forestry of the City of Cleveland, for the purpose of testing the value of the aeroplane as an instrument for distributing poison on tall trees. A six acre grove of Catalpa trees, containing 4815 trees, 25 to 30 feet tall, was selected for the work, these trees having been badly infested with caterpillars. The work of distributing the poison took only the actual flying

time of 54 seconds and thus established a world's record as to speed of applying insecticides to forest areas. The trials demonstrated the ability of the pilot to place the poisonous dust where desired, and at the same time the effect on the caterpillars was most gratifying, since it was estimated that 99 per cent were destroyed.

Aero Club of Illinois Landing Field

Mr. James S. Stephens, consulting engineer, reports that the Aero Club of Illinois has a flying field 1 mile square (640 acres) within the city limits of Chicago, located 10 miles 245° from the post-office building, between Crawford (Fortieth) and Cicero (Forty-eighth) Avenues and Seventy-ninth and Eighty-seventh Streets.

This field has been in operation for eight years and has all equipment for storage, repairs, and supplies, with attendance 24 hours per day. The field shows a very flat area covered with black loam, underlaid by yellow loamy clay. The site is free from trees or shrubbery except along the boundaries; it is higher than the surrounding property and will not receive drainage from adjoining territory.

The club hangars are located in the center of the field and the public-service hangars are on the western side.

To reach the field by automobile, drive south on Michigan Boulevard to Garfield Boulevard (Fifty-fifth Street), west on Garfield Boulevard to Western Avenue, south on Western Avenue to Sixtieth Street, west on Sixtieth Street to Cicero (Forty-eighth) Avenue, and south on Cicero (Forty-eighth) Avenue, 3 miles to the field.

The Aero Club of Illinois invites everyone to use this field.

COMING AERONAUTICAL EVENTS

AMERICAN

- Apr. 30.—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.
- May —National Balloon Race.
- Sept. 4.—Detroit Aerial Water (about) Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
- Sept. 15.—Detroit Aerial Derby, (about) Detroit. (Pulitzer Trophy Race.)
- Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

- Aug. 1.—Coupe Jacques Schneider. (about) (Seaplane speed race.) Italy, probably Venice.
- Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.
- Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

The AIRCRAFT TRADE REVIEW

Propose Air Map of Kansas City

A proposed ordinance now before the City Government authorizes the making of an aerial map of Kansas City, Mo., and appropriates \$10,000 for that purpose.

Under the direction of the Flying Club of Kansas City, and with the active co-operation of the municipal Government Chamber of Commerce and other civic bodies, the field on which the National American Legion Flying Meet was held last Fall has been made a permanent public field. Manufacturers, sales organizations and operators are now arranging for field privileges and facilities. It is believed that by the end of this month eight or ten aeroplanes will be located permanently at the field.

An organization doing business with the Flying Club of Kansas City is assured of sincere and efficient co-operation.

Virtually everybody in Kansas City, which, including the suburbs, has about 500,000 population, is enthusiastic over the project to make Kansas City, Mo., the hub of commercial air transport. Those desiring to communicate with the Flying Club of Kansas City should address Major Howard F. Wehrle, President, or C. S. Wengert, Secretary, 1221 Grand Avenue, Kansas City, Mo.

Travel Show

With President Harding's firm indorsement, what doubtless will be one of the largest and most important of industrial expositions and conventions is the Travel Show to be held in Grand Central Palace, March 25-April 1, under the auspices of the Travel Club of America. Many American industries and foreign governments will co-operate by making elaborate displays on three floors of the huge building in a manner which assures the success of the exposition. This has been planned as one of the features of "Travel Week" to arouse interest in the educational and recreational features of travel by sea, land and air; also what it reveals industrially to business men and women as a means of expansion of business and commerce.

Philippine Civil Air Service Suspends Operations

Owing to the failure of the Philippine Legislature to appropriate sufficient funds to defray the operating expenses of the Philippine Air Service for the year 1922, all of the Philippine Air Service property is being turned over to the Army, consisting of three HS2L Flying Boats, two F5L Flying Boats, one JN4D, accessories, three large steel hangars and one small building used as a storeroom. This property is now at Paranaque Beach. The flying boats will be removed to Kindley Field for storage, and the JN4D will be shipped to the Philippine Air Depot.

Foreign Trade Convention

More than one hundred trade advisers will be at the service of those who attend the Ninth National Foreign Trade Convention in Philadelphia May 10th, 11th

and 12th, according to plans which have just been announced.

These trade advisers will give information on any foreign trade question, and advice as how best to handle the problem. All of them are business men who have spent years in foreign trade. They will give their information and advice freely and willingly in order to further the best interests of American foreign trade.

A special delegation of Government experts from Washington will also be available for consultation. Consuls, commercial attaches, trade commissioners, economic and statistical experts will be at the service of all delegates to the convention. The convention will constitute an excellent opportunity for aeronautic executives to get in touch with foreign markets.

A New Gas for Dirigibles

The Aero Club of America on March 14 received from George B. Harrison, of the Aero Club of Southern California, the following telegram:

"I witnessed today demonstration of new gas called currenium which has about same lift as pure hydrogen, but is non-inflammable and non-explosive. Can be produced much as oxygen is made at probably fifteen dollars per thousand cubic feet. In test, flame and electric spark were introduced after gas was made and it was then sent aloft in balloon. Believe this is certain to have revolutionary effect in advancing lighter than air. Absolutely no doubt about practicability."

We shall present further facts on this subject in the near future.

Pilot and Aircraft Registration

In cooperation with the National Aircraft Underwriters' Association, Underwriters' Laboratories has opened registers of aircraft pilots and of aircraft. The plan is based upon the provisions of the convention relating to international air navigation agreed upon, subject to certain reservations, by the representatives of the allied and associated powers serving on the International Commission of the Peace Conference. The plan very closely follows the air regulations of the Canadian Air Board.

Pilots Register

Certificate No. 1001.

John Frederick Petre, Farmingdale, L. I.

Classification: Private and commercial, landing on land or water.

Certificate No. 1002.

Walter Becker, Newark, N. J.
Classification: Commercial, landing on the land only.

Certificate No. 1003.

Lloyd M. Marshall, North Rose, Wayne County, N. Y.

Classification: Commercial, landing on the land only.

Certificate No. 1004.

Edward Albert Johnson, Dayton, Ohio.
Classification: Private and commercial, landing on land or water.

Certificate No. 1005.

Rudolph W. Schroeder, Chicago, Ill.

Classification: Private and commercial, landing on land or water.

Certificate No. 1006.

William Duncan Tipton, Baltimore, Md.
Classification: Private and commercial, landing on the land only.

Certificate No. 1007.

Wilber Mantz Fagley, Kokomo, Ind.
Classification: Commercial, landing on the land only.

Certificate No. 1008.

Carl Brown Squier, Detroit, Mich.
Classification: Private and commercial, landing on the land only.

Certificate No. 1009.

John Arthur Yonge, Chicago, Ill.
Classification: Private and commercial, landing on the land or water.

Certificate No. 1010.

John A. Hambleton, Baltimore, Md.
Classification: Private and commercial, landing on the land only.

Certificate No. 1011.

Charles E. McKelvey, Seattle, Wash.
Classification: Private and commercial, landing on the water only.

Aircraft Register

(For identification only.)

AEROPLANES.

Nationality and Registration Mark
N-ABCA.

John M. Larsen, New York City.
Avro 504K, private, land use only

Nationality and Registration Mark
N-ABCB.

L. M. C. Drilling and Producing Co.,
Wichita, Kans.

Laird Swallow, commercial, land use only.
Nationality and Registration Mark
N-ABCC.

Akers Airphoto Corporation, Chicago,
Ill.

Avro 504K, commercial, land use only.
Nationality and Registration Mark
N-ABCD.

Ninimo Black Airport Corporation, Chi-
cago, Ill.

Laird Swallow, commercial, land use
only.

Nationality and Registration Mark
N-ABCE.

John A. Hambleton, Baltimore, Md.
Avro 504, private, land use only.

Nationality and Registration Mark
N-BMUL.

R. W. Schroeder, Chicago, Ill.
Standard JI, private, land use only.

Registration Mark XAAA.
Walter Becker, Newark, N. J.

DH6, commercial, land use only.

SEAPLANES.

Nationality and Registration Mark
N-ABCF.

Loening Aeronautical Engineering Cor-
poration, New York City.

Loening Flying Yacht, commercial,
water use only.

LIGHTER-THAN-AIR.

None registered.

Certificates of Airworthiness

It is expected that a procedure covering the necessary inspection of aircraft looking to release of certificate of airworthiness will be operative early in 1922.

THE RITH NON-RIGID DIRIGIBLE

By WILLIAM KNIGHT, M. E.

IT IS very gratifying to see that a few days after the accident of the Roma, the organization of the General Air Service was announced in the daily press. This shows that we are looking upon the future of aerial transportation by dirigibles in the right way, without being discouraged by the latest accidents. There is no question about the fact that this country is especially suited for this kind of service and the plans of the General Air Service, as outlined by Mr. Crowell, President of the Aero Club of America and one of the active members of the Organization Committee of this new corporation, are such as to bear promise of some very interesting developments in dirigible construction and operation in this country. We have everything which is needed for taking the leadership in this field and it is hoped that the public at large will realize the tremendous importance of this leadership both from the point of view of national defense and from the point of commercial relations between the far commercial centers of this country and eventually between this country and the rest of the world. The accidents of the ZR2 and the Roma are far from being sufficient elements for condemning the lighter-than-air.

Great Britain at the end of 1918 had more than one hundred dirigibles which, during the war, had flown about 250,000 miles without a single accident except that which occurred in an experimental dirigible of a new type, the reasons for which were not well determined at that time.

France had between 20 and 40 dirigibles in service between 1917 and 1918 which in the last year of the war had flown about 600,000 miles without a single accident.

Even the Roma before being brought to this country had been extensively flown all over Italy, carrying hundreds of passengers without a single accident. It is too early yet to determine accurately the reasons why the accident of the Roma happened. All indications, however, seem to point as a direct cause the snapping of a cable which put the elevator out of commission. That the accident was aggravated by the fire which spread out in the dirigible after touching the ground cannot be considered as a deterrent in dirigible construction considering that we have developed in this country the means of producing helium at a sufficiently low price and the helium when used instead of hydrogen in dirigibles will entirely eliminate the fire risks. The fact however remains that if the prime cause of the accident was due to the fact that the elevator was put out of commission, this might happen again under the same circumstances.

Since one year ago I have been in possession of the complete plans of a new type of a French dirigible designed by Leon Rith, a brilliant French engineer and an authority in aeronautics. Mr. Rith was for ten years the director of the Eiffel Laboratory. The Rith dirigible is essentially a non-rigid. I have brought this project to the attention of a number of people interested in this type of construction in this country and abroad and an Organization Committee is now being formed in France for developing this design. This Committee, beside Mr. Rith, comprises Mr. Lizeray, President of the French Society of Inventors; Mr. Marchis, Professor of Aeronautics to the Sorbonne, Paris, and President of the "Chambre Syndical" of French aircraft manufacturers; Mr. Capazza, President of the Committee on Dirigibles of the Aero Club of France; Mr. Sabatier, who is the designer and builder of all the Clermont-Bayard dirigibles; Mr. Mallet, designer and constructor of Zodiac dirigibles, and others.

The plans made by Mr. Rith anticipate that to build a 52,000 cubic meter non-rigid dirigible it will take 10,000,000 francs, for the first one. Subsequent dirigibles of the same size might be built as low in price as 4,000,000 francs. In a paper recently presented by Mr. Rith to the First International Congress on Aerial Navigation, which was held in Paris last November, the main points about this project were outlined and I have secured from Mr. Rith the permission to publish in this country the complete matter of calculation of this non-rigid dirigible which I will publish later on. In the meantime, I think it will serve the purpose of attracting the attention of the Government and organizations interested in dirigible construction in this country to give the same general outline as it was given by Mr. Rith in his publication to the First Aeronautic Congress on Aerial Navigation.

It is quite obvious that before aerial transportation by dirigibles can be adopted as a commercial carrier, the price of transportation must be sufficiently low to attract the necessary volume of traffic needed for the successful commercial operation of dirigible lines. In order to have low price of transportation we must necessarily use dirigibles of large cubature, capable of transporting great loads over long dis-

tances. At the present time the dirigibles of large cubature are only of the rigid type and this type of construction involves great expense of construction which must be borne by the operation of them. Also the design and construction of these huge dirigibles present some serious difficulties in the matter of calculation of the rigid armature, which furthermore represents a dead load which must necessarily increase the cost of operation. The semi-rigid type is less expensive in construction and lighter than the rigid type; but, so far, dirigibles of this type have been made only in smaller sizes than the rigid, and the point is open to discussion if the semi-rigid type represents an improvement in the matter of security over the rigid and non-rigid types, or if this type rather combines the disadvantages of both of the others without having the advantage of either of them. The opinions in this matter are open to further discussion and experimentation before definite judgment can be passed on the semi-rigid. The non-rigid type offers the following advantages over the rigid and semi-rigid:

First:—The design, the construction and the assembling of a non-rigid can be effected in a much shorter time than in the other types. No hangar is needed for erecting a non-rigid.

Second:—The price of construction is from four to five times less than in the rigid.

Third:—No fragile metallic armature enters into the construction.

Fourth:—Due to the absence of the dead load of the metallic armature, for the same cubic contents, a non-rigid dirigible can lift a larger commercial load than the rigid.

Fifth:—The consumption of fuel required for a non-rigid, for the same commercial load carried, is less than in a rigid.

Sixth:—Due to the absence of a rigid metallic frame no hangar is needed for protecting the dirigible on the ground from the action of the wind, and in any case for an exploitation requiring a large number of dirigibles, a considerably low number of hangars are required.

Seventh:—The price of the ton per mile is necessarily lower than in a rigid dirigible due to the advantages pointed out before.

Up to the present time, however, these advantages of the non-rigid type over the rigid have been counteracted by the fact that in the non-rigid neither large cubatures or great speed could be safely obtained.

In a great inclination of the axis of a dirigible over the horizontal, which might be produced by a number of causes without always having the time to correct them, the tension in the gas bag at the end which is more elevated is greatly increased. Furthermore if the air ballonets are partially full, the gas lighter than the air has a tendency to rush towards the elevated end of the balloon, thus giving rise to sudden blows which are so much more powerful as the cubature of the balloon is larger. We thus have new stresses in the gas bag which are added to the static stresses due to the inclination of the airship on the horizontal. In order to have the gas bag sufficiently strong to resist these forces, we should considerably increase its weight. The transversal gas partitions do not help much under these conditions because they will deformate and their deformation cannot entirely be prevented by the use of cables without hindering the use of the ballonets.

A dirigible which is advancing at a certain speed in the air is subject to the same condition as if it were kept stationary in a strong wind. Under these conditions it is almost impossible to keep the axis of a non-rigid dirigible always in the direction of the wind. As soon as a movement of a rudder or any other condition slightly changes the direction of its axis in relation to the direction of the wind, the action of the wind will have a tendency to still further increase the angle between the axis of the dirigible and the direction of the wind. The result is that a non-rigid dirigible flying in the air follows an unstable route which must always be corrected by the rudders. Unless the gas bag is subjected to relatively high internal pressure it must necessarily bend and the dirigible will be subject to some snake-like movements in its flight.

In order to be able to build dirigibles of the non-rigid type and a large cubature, we must devise some means for giving to the dirigible a sufficient degree of rigidity and also we must stabilize the nose of it. In the Rith dirigible the rigidity is obtained (see Fig. 1) by using a bi-convex ballonnet in the middle of it in which the gas pressure is maintained slightly superior to the external gas pressure on each side of it. In this way the two sides of the ballonnet are under pressure and in case that a rapid inclination of the axis of the dirigible

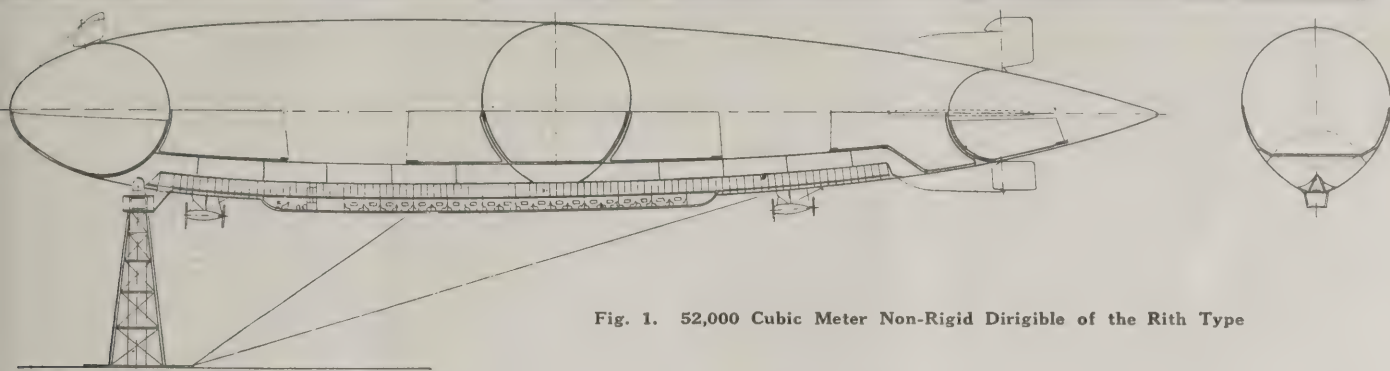


Fig. 1. 52,000 Cubic Meter Non-Rigid Dirigible of the Rith Type

over the horizontal should occur, either one side or the other is ready to resist the impact of the gas. At the same time the movements of large gas masses is prevented the same as the sudden blows that we have mentioned before. This central partition ballonnet contains hydrogen as well as an air ballonnet. The excess pressure in the partition ballonnet can be slight and is useful only in case of sudden changes of the direction of the axis of the dirigible with respect to the horizontal.

In order to stabilize the nose of the dirigible, Mr. Rith's project provides automatic stabilizing planes each rotating around an axis perpendicular to the direction of the relative wind, and located at the front end of the dirigible. The automatic operation of each plane is produced by a wind mill. The axis of rotation of each stabilizing plane and the axis of the corresponding windmill are connected to each other by an articulated parallelogram or by a cable passing over pulleys of slightly different diameters. For regulating the action of these automatic stabilizers and for eventually preventing vibrations from taking place, tests shall be made by which the best ratio of the pulleys, diameters, and the dimensions of the automatic control planes shall be determined. Anyway these automatic control planes need to be very small, due to the fact that they are located on the front of the dirigible, which renders their action a good deal more powerful than the control planes placed on the rear. It should be easy to calculate the mechanical attachments of these planes so as to make them sufficiently strong. Under these conditions the dirigibles shall be able to advance in the air without deviating from the straight route, due to the fact that its inertia is considerably larger as compared to the inertia of the automatic stabilizing planes. The increase in weight and the added air resistance due to these automatic control planes shall be very small or even none at all, because it can be possible to greatly reduce the rear control planes which are less efficient. In order to prevent the action of these automatic control planes in front of the dirigible from interfering with the action of the rudders on the rear it shall be sufficient to arrange a cable transmission leading to the pilot pit which will allow the pilot to act at the same time both on the front and the rear planes simultaneously, the motion of the control planes in front of the airship being the reverse of the motion of the corresponding rear planes. In this way the dirigible can turn more rapidly and can ascend or descend preserving always the horizontal position. When the dirigible strikes a transversal wind, the front control planes automatically accomplish the necessary maneuvering for keeping the ship in the desired direction.

In conclusion the new design by Rith (if its practical realization shall prove to be successful) allows to build non-rigid dirigibles of large cubature and great speed of a simple and economical construction and easy operation without increasing either the weight or the air resistance to any appreciable extent. Fig. 1 gives the outline of a 52,000 cubic meter dirigible with helium compartments designed by Rith. Only one central partition ballonnet has been considered necessary for this design. Two others similar ballonnets are located at both ends of the ship; the one at the front end being subject to a pressure slightly above the aerodynamic pressure prevailing at that point in flight. The rear ballonnet being under pressure offers the advantage of providing a better support for the control planes. The length between either the front or the rear ballonnet to the center ballonnet is not larger than the length of a small non-rigid dirigible. If more than one ballonnet at the center shall be needed this can be done without increasing the weight to any appreciable extent. In a military dirigible it would be desirable to have, instead of one central partition ballonnet, two of them placed on each side of the center of gravity. This would allow the throwing of heavy bombs without any danger. These two partition ballonnets would not in any way prevent the establishment of static equilibrium by using double air ballonnets.

Only three stabilizing planes on the front of the balloon of

the dirigible have been anticipated on this design, but if four should be found to be necessary, they may be easily installed without interfering with the mooring mast. Two other particulars of this design are worth mentioning. One is the carriage placed at the front end of the ship moving on a rail around the mooring mast. This it is anticipated will reduce the vertical oscillations of the ship when it is moored and allow unloading rapidly without losing gas. (See Fig. 1.)

The other particular of this design is the provision made for using helium in a series of compartments located above the passengers, cabin and all other places subject to fire risks. In Fig. 1 it is given the transversal section of this balloon when helium compartments are used at the bottom. The surface separating the hydrogen and the helium shall consist of two light fabrics; the lower one has some holes in it, the upper one is gas tight, and of a larger surface so as to allow for the expansion of the helium. The upper dotted line shown in the transversal section in Fig. 1. shows the position of this separating surface in the expanded position. The lower dotted line shows the position of the partition, if, due to an accident, a helium compartment should break letting the helium escape. Altogether the volume of the helium used in this design will be about one-tenth of the volume of hydrogen used.

It is not the intention of this article to put forth the idea that non-rigid dirigibles should be used instead of either rigid or semi-rigids; all of them might offer some advantages and some disadvantages, but considering the fact that the design and construction of lighter-than-air is far from having reached the point when any of these types can be considered to be perfect, there is room for giving consideration to all types and to decide by ourselves later on which is the most satisfactory one and which one we should adopt for operating commercial lines.

There is no question that if non-rigid dirigibles can be built just as safe, as large and as fast as rigid dirigibles, all other conditions being the same, we should prefer to build non-rigid dirigibles which for the same cubic content can carry more load, can be built at a much lower price and shall require much less hangar space than the rigid dirigibles.

This, of course, needs to be proved yet and this is what Mr. Rith and the other members of the French Organization Committee, working on the organization of a Company for building a dirigible of the Rith system, shall try to prove.

This country, as Mr. Crowell has recently pointed out, is at the present time in the most favorable conditions for taking away from Europe the leadership in dirigible construction and operation. We can do it and eventually we will do it, but in order to do it we must not be discouraged by the recent accidents of the ZR-2 and the Roma and we must not condemn or fall in love with any particular type of dirigible at the present time. We must follow with the keenest interest what is done in the rest of the world in dirigible developments and we must try to be on the job at an early stage of the game in the development of new ideas bearing a fair promise of success.

A few new ideas in dirigible design has attracted the attention of technical and business men in Europe recently. One of these is due to Rith and it bears a promise of being successfully carried through in France, with both French and foreign capital. Another is due to Vaugan—and Gargiulo. A model of the Vaugan-Gargiulo rigid airship using air at a variable density instead of hydrogen was exhibited at the latest "Salon" in France last year where it attracted a good deal of interest, and a dirigible of this type is now being built in Italy. Dr. Junkers in Germany has also been working at a new idea in dirigible design and experiments in line with this new design have been carried through by him in the last two years in his laboratory at Aachen.

I feel confident that the Government and business men interested in securing for this country the leadership in the air shall follow very closely what is done in Europe at the present time and shall take the necessary steps to that effect.

FROM JUNGLELAND INTO SKYLAND

By HERMANN NORDEN

FOR months I had been in Further India and Malaysia, with all that it means of experiences in the grotesque spots of the earth, among strange and primitive peoples. On the return voyage the Island of Perim at the entrance of the Red Sea was our first port of call in twenty days—a necessary stop for coal. At the "Club" I picked up an English newspaper, the first I had seen in months. The thing most arresting to my attention was an advertisement of regular air lines between the important capitals and commercial centers of Europe. Travel by air service on schedule time, rain or shine—here was indeed a change during my jungle residence! The desire to add the sensation of flying to my experience was irresistible. Then and there, by wireless with Marseilles, I made reservations on all lines, which enabled me to make—literally—a flying visit over the greater part of Europe, and once more get in touch with civilization in an incredibly short time.

The result was that I changed from my cabin on the Rott. Lloyd S. S. "Tambora" to the not less comfortable cabin on the snowy, heavier than air, yacht-like Farman. I said goodbye to the venerable, grey-bearded Dutch sea captain, and was received by a youthful, clean-shaven Frenchman, an ex-war pilot. A fine chap he was, like the air pilots of all nationalities that I met later. Modesty and reticence are their chief characteristics, as manifested in talk. Their experiences, if told, would make a thrilling book.

Before starting, my pilot scanned the sky, just as an angler scrutinizes the water; just as my native guides in the jungle inspected the thickness of the woods and sniffed the various scents. The interpretation of the play of clouds is important. Accumulations that resemble snow hills on the horizon will dissolve in rain. Clouds that cling like parasites to mountain tops will dissolve in rain. Some clouds are mysterious with hidden meaning.

"You needn't bundle up as though you were going to the Arctics," he told me. "We won't fly higher than 3,000 feet, nor go faster than 80 miles an hour. I can easily go 100 miles. Certainly you can smoke. When we get up you can do anything you like, but please don't move about the cabin while I am getting her up or when I am making a landing. If you get airsick open the window or use the receptacle. We have a nice day with the wind behind us. It won't be stormy."

He took his seat amidship behind me in a little elevated glass enclosure, and started the motor. I was indeed cosy in a comfortable, well-upholstered club chair by the window, a vase of flowers fastened to the wall between the curtains. Around me was my luggage, the thirty pounds which is the limit allowed. The cabin had mirrors and a few photographs. Later I travelled in open aeroplanes with the pilot seated in front. This is in many ways more thrilling, but for solid comfort, especially when one wants to read or write, the planes with cabins are preferable.

Off we went over the partly rough field. It was as if we were in an automobile, but in a few minutes the ground was left behind. Slowly circling once around, we climbed higher and higher.

One look behind at ocean and the steamer which had been my home in tropical climes; then forward on and on, over housetops and steeples, white castles surrounded by parks, green forests, the long red roofs of monasteries, the spires of ancient cathedrals. On over hill and valley, over black ruins and brown plains where battles had been fought, then across a chain of mountains with azure sky above, we sailed close to the silvery clouds in that bracing dustless air and sunshine. I thrilled with happiness at having lived long enough to enjoy this delight.

We made a landing as smooth as the start. We had stopped for a change of pilot and plane, for we had come to the frontier of another country. As we rose again, the view disclosed a checkerboard of lawns; a cemetery which was no more than a stretch of white dots, monuments to those who rest beneath them; fields with grazing cattle and horses that looked small as ants; villages large and small, flower gardens, woods, grey and red roofs, yellow haystacks among windmills

—it is so that a great country looks from the air. The realization of being at a high altitude has less effect on the brain than has the small aspect of things. How could one be fearful or dizzy when looking over toys! It was fascinating to watch the altimeter register the height at which we were flying.

The plane swept low, and we saw rabbits racing in a circle, trying to save themselves. Up again over country that looked like a mosaic, or like huge stretches of mother of pearl, beautifully colored, with rivers and canals intersecting them. Railroad tracks, with their tiny moving trains, glittered in the sun. A few minutes more and we dropped suddenly. The sensation was like that experienced when an elevator falls several stories. I thought we had struck a hole in the air—a

thing I had heard about, but no, it was not that. To please me the pilot had lowered the plane over a race course near a big city. He circled twice over crowds and tracks, gay with flags and bunting. The horses looked like terriers; the people like dolls. Toyland, indeed!

My moods varied as much as did the scenes. Never had the world seemed so insignificant to me as on that first air journey. There came a feeling of utter irresponsibility, and a wish to fly on to where the sun was setting on the far rim of the horizon. Or, if I must return to earth, why not disappear forever from my usual haunts; become a hermit in a forest or on a mountain top, or finish life in a monastery, engaged in reflections? But with the change in the scene below came a different mood. I felt a boundless pride in being of the family of beings who have conquered the air with mechanical power; who with their genius have supplied the wings denied by nature.

All peoples have had their myths about flying; from the very beginning it has stirred the desires and the imaginations of men. There is the old Greek tale of Daedalus and Icarus, who made themselves wings. Then there was Archytas, a scholar of Pythagoras, who is credited by old historians with having caused a

wooden duck to fly by enclosing his breath in it. The Chinese and Hindus, with their ancient culture, have similar legends, and even the animistic tribes among which I had recently dwelt have myths about the only element which for untold centuries defied man. Until now! The dreams of our forebears have become reality. A new era has begun.

With Lord Clive, I would stand aghast at my own moderation were I to try to enumerate the benefits to mankind brought by this great achievement. Civilization, whose progress has ever depended upon communication between the different peoples, will receive a fresh impetus. Not to speak of fanciful sounding but nevertheless true statistics of savings to commerce. Air travel may bring an Eldorado to the lovers of arts and letters, for new schools of art may spring into being because of it. The followers of the trail of Pegasus have always drawn their deepest emotions from the blue vault of heaven. Longfellow responded to its eternal inspiration:

"And from the sky, serene and far,
A voice fell, like a falling star
Excelsior!"

Perhaps there was a dream of flight on the part of Philippe Desportes when, in the sixteenth century, he celebrated Icarus in his famous sonnet:

"Icare chut ici, le jeune audacieux,
Qui pour voler au ciel eut assez de courage."

In our day many audacious youths have courage enough to fly to heaven.

Who, at the approach of springtime, has not felt that he would like to follow the birds, gayly winging over forests, meadows and lakes; rejoicing in landscape and pure air. I was surprised to find myself singing while in the sky, but learned that even old birds at the game do the same thing. "We all sing on long rides," my pilot said. "We don't know why, but we do."

Of course I did not feel like singing at all times. Certainly not when the chair I sat on in a Farman broke to bits beneath me and I rolled on the floor. We had started up at a sharp angle without describing the usual circle. Not until the pilot



Hermann Norden, Explorer and Author

had righted the machine could I pick myself up and find another chair.

An experience of a more serious nature happened one afternoon. The pilot sailed straight into clouds which, from a distance, had looked like a thin layer. For a moment everything seemed right; the sun was like a target enshrouded in fog. Suddenly it grew dark. The sun was gone and the clouds blew, roaring and whistling, about the open plane. Then, as quickly as it had disappeared, the sun came into view again, first a glimpse, then full view. But instead of being above, it was now below us. Another moment it was swallowed again in thick grey clouds, and so were we. The experience might have gladdened the heart of a jungle dweller who would have believed himself near his ancestors, whose spiritual abode is in the clouds. My thought was, "What a pity. It's all over." But it was anything but over. The plane had merely been turning round in the clouds, and upside down flying is as easy to a cool-headed pilot as is flying in a normal position. The practice of the so-called "stunts" is a highly necessary adjunct to the training of an aviator, so that he may feel at home under any conditions.

I had not intended to go in for any stunts, but enjoyed some notwithstanding, on a flight between Madgeburg and Hamburg. Our craft was a battered old German one-passenger ex-war plane. I must have impressed the young pilot with my enthusiasm for flying because he made a "loop the loop" when over the Alster Basin. He turned and shouted something over the isinglass partition which separated us, and before I realized what was happening, had done it again. Since it was not a windy day I had not been strapped in, so was kept busy holding on to the loose ends of straps to keep from falling out of the machine. Below us was the grandest moving picture imaginable, or so seemed the large town of Hamburg with its harbor, its ships on the river, its tree-lined avenues

and crowded streets, as we saw it from the different angles that the pilot turned at only a small elevation above the Basin, which lies in the center of the busiest part of the city.

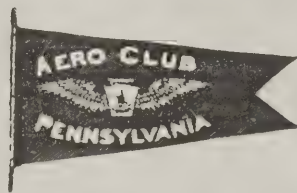
But it is here at home that I have had my best flying experience. Last week in a Fokker express biplane I was introduced to the "Wing-Over" and the "Immelmann turn" by Bert Acosta, one of the great aviators in this country. I had not known that there were such high mountains on Long Island, nor that the sky is its foundation, with the ocean, coast and sands above it. The villas, dwellings, farms and haystacks are in perpetual motion, and seem constantly in danger of colliding with the innocent traveller in the air, sometimes in dizzy altitudes; sometimes in the forbidding clefts below. Or so it looked from inside the comfortable little coupe, while it turned the different angles, climbed endless heights and shot to bottomless depths, all with incredible speed.

It was night when we returned in a straight flight. A full moon shone, and there were stars below us as well as above, for so the lights in dwellings and along the road looked. As I motored back to New York, partly over what used to be the Vanderbilt track for automobile races, I thought of those first races not more than about a score of years ago. People talked then of motoring as they do now of flying, and the danger is just as little. It all depends on the make of the machine and the coolness of the man at the wheel, the greatest of all uplifters.

Strange that the trail of the air, the trail of health and untold delight which will take us in one flight from the Atlantic seaboard to the Pacific Coast is so long in becoming popular with us. American genius and perseverance have made the dreams of our forebears come true. The air is ours to travel in.

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AVIATION enthusiasts of Philadelphia have derived much satisfaction from the rumors that have been semi-officially reported that this city will in all probability become the greatest aviation center of the country. Extensive plans are at present under consideration by the national government and the city officials. It has been reported, but not confirmed, that the Naval Aircraft Factory at the League Island Yard which is already the largest aeroplane plant in the country, is to be enlarged and that the aviation committee lately appointed by the Philadelphia Chamber of Commerce will soon recommend a site suitable for a landing field.

Rear Admiral L. M. Nulton, Commandant at the Navy Yard is enthusiastic over the plan and the aid of Mayor Moore has been enlisted. "If the government is to have fewer warships in commission it will need more air service," said the Admiral, "and the big chance for the Philadelphia yard is to jump into the lead as headquarters for all that is best in aviation for the benefit of both army and navy, with a great possibility of commercial development which would help reduce government expenses."

Mayor Moore in discussing the situation said that he is greatly pleased with the prospects of making Philadelphia the aviation center of the country. The Mayor commissioned Director Caven to recommend a suitable site after searching the city and Director Caven proposed the property on the Delaware River near Essington for the flying field. The city bought the property several years ago and is paying a rental of \$400 yearly to the authorities of Delaware County.

Several other sites were also proposed by Director Caven and a full report on all being forwarded to Admiral Nulton. The Mayor conferred with the Admiral on the proposition and Admiral Nulton promised to inspect the Essington site and see if same is suitable. Mayor Moore promised to do all in his power to bring this government field to Philadelphia and if the site recommended is declared unsatisfactory he will keep on until a site is secured that will assure this city the honor of being the headquarters of the Government air service.

The Aviation Committee appointed by the Chamber of Commerce of Philadelphia, and which is composed of expert fliers and many citizens prominent in aeronautical work, has made a preliminary report that the Roosevelt Boulevard section, the suburban district west of the 69th Street Terminal and the

filled in section north of League Island constitute three desirable sites for an aviation landing field. Although these locations have the necessary requirements of accessibility, safety and area for the development of commercial aviation with the city as a center, final determination as to which is the most suitable site must wait until a location is selected for the Sesqui-Centennial.

Mr. Joseph A. Steinmetz, president of the Club is one of the most active workers of the Committee. "A survey of property values in the three districts suitable for aviation," the committee says, "would indicate that neither the Roosevelt Boulevard nor the 69th Street locations could be purchased for less than \$150,000 to \$200,000, whereas seventy-five acres of the proposed League Island site are already owned by the city and appear on the city plan as an aviation field. The League Island site, has in the estimation of the committee, the advantage of being adjacent to the river and so will connect up directly with future hydroaeroplane operations. The intersection of the Delaware and Schuylkill Rivers makes an excellent landmark for night flying and for those not thoroughly familiar with the environments of Philadelphia."

Congress is investigating the possibility of again placing Philadelphia on the air mail map. The extension of the air mail service with Philadelphia as a center is also under consideration by Congress in connection with betterments of the service.

The Philadelphia Chamber of Commerce has been requested to determine the stand of Philadelphia business houses on the extension of aeroplane mail service. The effect of the extension upon Philadelphia business, especially the banks, is an important factor, it is declared. The Postoffice Committee of the House of Representatives has asked for full details concerning the value of business transacted by mail in and out of Philadelphia. The Committee also asks whether there is a municipal landing place for aeroplanes here and whether there are any private aircraft companies competent to guarantee a successful carrying out of a mail contract.

It has at last been officially announced that the Aero Club of Pennsylvania has been admitted to full affiliated membership in the Engineers' Club of Pennsylvania. As the Engineers' Club is strictly a technical group of the highest engineering standing the honor conferred is of the highest and will be much appreciated by the members of the Aero Club. Those members of the club who are interested in aviation from an aeronautical engineering standpoint will no doubt become members of the Engineers' Club which has among its members the most prominent engineers of the city of Philadelphia and vicinity.

W. H. SHEAHAN,
1st Vice President.

COMMERCIAL AVIATION DEVELOPMENTS IN EUROPE

By W. KNIGHT, M. E.

(Continued from page 46)

ENGLAND

Governmental Organization of Aerial Services

Civil aviation in England, as it is well known, is under the direction of a "Comptroller General of Civil Aviation."

All the research and technical work is under a "Director of Research" which supplies such technical work as is needed both by the departments of commercial and military aviation and awards prizes for encouraging aircraft manufacturers to produce the required new types according to specifications issued by the Air Ministry, (which unites all the aerial services), thus helping a good deal in keeping alive the aircraft manufacturing industry in Great Britain.

It is due to the good organization and to the efforts of the "director of research," that recently some aero engines superior in many respects to those produced by other nations, have been designed and manufactured.

The department of research has even gone to the length of ordering experimental civil air transport aircrafts, camouflaged as war machines, so as to help the aircraft manufacturing industry to struggle along waiting for better days to come. The result has been the development of several promising passenger carriers which will have a chance of proving their worthiness this year, if the Department of Civil Aviation in England is allowed to continue to exist.

In the matter of communications, (signals and navigation) progress has been made by direction-finding wireless and it is stated that now both Pulham and Croydon have been provided with stations working in connection, making it possible for aircraft to determine their position by bearings obtained simultaneously from the two stations. Other wireless stations are located at Berwick, Carnsore, Farmborough and Lizard. All of them using a wave length of 450. The wireless stations of Croydon and Pulham using both a wave length of 900.

The radio telephone service with aircraft has been further developed. All British machines employed on the cross-channel service carry telephones and as soon as the ratification of the international air convention has been deposited, regulations will be issued which will make it compulsory for aircraft carrying ten passengers or more to be equipped with wireless.

The aero-port at Croydon is at present to London what Bourget is to Paris. It has, however, been suggested that the airdrome at Lympne might be used during the winter months rather than the Croydon, in fact, when the pilots figure that due to bad weather it would be unwise to land at Croydon, they will, in the future, be allowed to land at Lympne, forwarding the passengers to London by train. Up to the present time for the cross-channel service, starting from England, the air-port of Croydon is used. Some operating companies, however, are figuring on starting their trips from Lympne during the winter months.

Largely as a result of the experimental flights of the R-33, arrangements are now in course of completion, whereby the Croydon-Lympne route could at short notice be opened for night flying.

In general it might be said here that the technical services under the "director of research" are better organized and more efficient than the organization of aeronautical technical services in France.

Commercial Operation of Aerial Services

The London-Paris air service which is the most active one, is operated under the temporary subsidy scheme entered into by the Government with the Handley-Page and the Instone Companies.

To enable the British companies to compete with French companies subsidized by the French Government, which due to an increase of the subsidy were able to effect a cut in rates of 40%, in 1921, the British Government assists them by financing the acquisition of modern commercial planes on a re-payment basis and guaranteed a profit. The service has been in operation throughout the summer of 1921 with satisfactory results. It is found that few machines of an improved commercial type are available, and the temporary nature of the arrangement rendered it financially impracticable to provide last summer large numbers of these machines.

In spite of these handicaps, however, there was a considerable increase in the average load carried per flight.

This temporary arrangement is proposed to be superseded by a permanent scheme of subsidies by the Government on a 25% basis, including the hire-purchase scheme by which firms are able to acquire machines of types approved by the Government at less than the cost price.

The latest report issued by the Comptroller of Civil Aviation states, however, that by August 1, of last year, the date on which the scheme was to have come into effect, the experience gained during the summer had shown that the scheme as originally proposed was not likely to provide adequate assistance and it was therefore amplified as follows:

"An additional grant of three pounds sterling and three pence per pound of freight, will be made to approved firms during the year ending February 28, 1923, while in addition a contribution towards the insurance of machines provided by the Air Ministry under the hire-purchase system will be made in the sum of 50% of the premiums up to a maximum of 10% of the value of the machines. The scheme, it is hoped, will become operative in March, 1922; meanwhile special arrangements, similar to those now prevailing, are being continued for the operation of the London-Paris service during the winter months of 1921 and 1922."

The report also states that it is considered that it would not be desirable to have unlimited competition among aerial operating lines. The number of the operating firms has, for the time being, been limited to four. Of these, the Handley-Page, the Instone and the Daimler-Hire have been chosen to operate the London-Paris route, while one firm only, the Aerial Route Syndicate Ltd., has been selected to run the London-Brussels service. It is stated that the Air Council does not contemplate approving more than three firms at any one time on the London-Paris route, also reserving the right to approve other firms, should the circumstances warrant it.

Table No. 11 gives the number of trips made carrying passengers, mail and express matter and the trips completed to schedule over the line, Paris-London and vice-versa; London-Brussels and vice-versa; and London-Amsterdam and vice-versa. The regularity of the service as evidenced by the percentage of trips completed is very gratifying, varying as it does from 90 to 93 1-2. The total mileage flown from January 1st to October 30, 1921, is about 700,000 miles. 3,088 trips were made, during which 10,228 passengers were carried. Two accidents only resulting in the death of one or more occupants occurred in 1921, from April 1st to September 30th. Two accidents resulting in injury to occupants and six accidents resulting in non injury to occupants also occurred, making a total of ten accidents. From April 1st to September 30th, the number of miles flown per accident was 32,000 and the number of flights completed per accident was 1,718 and the number of hours of flight per accident was 415, only a percentage of .03 passengers killed per 1,000 carried, and .03 injured per 1,000 carried, was the result of the six months of operation. These figures speak well for the safety of modern flying and as they show a considerable decrease in accidents as compared with the corresponding period of 1920, it may be assumed that as machines and organization improve, the percentage, as small as it is, will be still further reduced.

The number of arrivals and departures of aircraft from the Continent between April and September, according to nationality, were as follows:

British	671
French	1058
Belgian	339
Dutch	292

The number of passengers carried on the same routes, during the same period by machines of the different nationalities were:

British	4006
French	3499
Belgian	597
Dutch	420

The total value of imports (free and dutiable) by air from April to September was 206,357 pounds sterling, and that of the exports was 110,400 pounds sterling. The estimated

number of outgoing letters posted for transmission by air was 42,840 and the number of incoming letters was 38,696. On the London-Paris route, the efficiency of the outgoing air mail service was 95%. On the London-Brussels route, 70% and on the London-Amsterdam line, 89%.

Conclusions:

As in the case of France the British Government is taking quite a lively interest in the development of aeronautics in Great Britain. The aircraft manufacturing industry in England is in a far better shape than in France, but France is ahead of England in the organization of operating companies. In England as in France a good deal of interest is evidenced in the establishment and the development of an efficient ground organization and especially with reference to the meteorological and wireless services. In England as in France the question of the aircrafts used so far explains in part, the financial failure of the operating services. The aeroplanes used as carriers were also, in this case, a modification of the war types, entirely unsatisfactory for commercial purposes. Only during the year 1921, in Great Britain as in France, types of aircraft, better adapted to commercial operation began to appear. The air mail and the passenger service is becoming every day more popular, and although it is as yet far from being satisfactory, the service is increasing in volume in a way which is promising of less discouraging financial returns at the end of this year.

TABLE 11
Civil Aviation in England from Jan. 1st. to October 30th, 1921.

Route	Distance in Mls.	No. of Trips	Pass. Arrived	Trips Carrying Mail	Trips Carrying Express Matter	Trips Comp. to Schedule	Percent. Trips Completed
Paris-London	233	1141	4581	435	787	1021	90
London-Paris	233	1110	4521	317	407	1033	93
London-Brussels	210	260	298	148	153	243	93.5
Brussels-London	210	226	353	177	173	201	89
London-Amsterdam	265	176	200	160	166	167	95
Amsterdam-London	265	175	275	164	147	162	93
Total		3088	10228	1401	1833	2827	91.5
Total Mileage Flown—700,000 miles.							

BELGIUM

Governmental Organization of Aerial Services

In Belgium more than in France and England, the Government has contributed mostly to the development of civil aviation, in fact, we might safely say that up to the present time almost all of the aeronautical activities in Belgium are under the direct control of the Government. In June, 1919, due to the initiative of King Albert, a committee was established for making recommendations about the establishment of aerial navigation lines in Belgian Congo, which is known in Belgium as the C.E.N.A.C. This committee is composed of three members, one representing the ministry of colonies, another an aeronautical expert, and the other the director of civil and military aviation, (who are united under the same direction). The program assigned to the C.E.N.A.C. was (1) to establish an experimental aerial commercial line between Stanley-Pool and Stanleyville, and two millions of francs were put at the disposal of this committee for starting such an undertaking; (2) to investigate the possibility of making, by means of photographs taken from aeroplanes, the map of rivers flowing through the interior of the Belgian Congo. Up to the present time the second part of the program assigned to the C.E.N.A.C. has not been tackled yet. The realization of the tasks set in paragraph one, was effected by making a contract with a "National Syndicate for the study of aerial transports" which is known in Belgium as the S.N.E.T.A., and which was charged to start the exploitation of the first aerial line in the Congo. The S.N.E.T.A. is a society which has been established for, (1) the study of aeronautics and their practical application in all branches of civil aviation, industrial, commercial, sporting and colonial; (2) to exploit aerial routes, national and international in the Belgian colonies, and in Belgium for the transportation of passengers, mail and freight; (3) to construct and repair aeronautical material and accessories, required by military and civil aviation. This society, as can be seen, covers pretty well the whole field of civil aviation in Belgium. Due to the obvious fact, that during the war, the Belgians

were literally turned out of their own country, they were not in a position to develop either the manufacture of aviation material or the building of aircraft. In spite of this, however, there are plenty of excellent pilots and mechanics in Belgium, trained in the school of war. The S.N.E.T.A. is supported by the Belgian Government for the purpose of creating a national aircraft manufacturing industry and allowing it to survive the competition of foreign aircraft manufacturers, which could not be possible at the present time without the financial support of the Government. Twelve Levy-Lepen hydroplanes were turned over by the Belgian Government to the S.N.E.T.A., with sufficient spare parts and twelve hangars. Besides this, the Belgian Government put at the disposal of the S.N.E.T.A., the personnel needed for the operation of the service and the facilities of the shops attached to the naval base of Leopoldville. The entire distance covered by the exploitation of this line is 1,070 miles and it was divided into three sectors, as follows: First Sector: Kinshasa 0 Miles
Bololeo 195 " Second Sector: N'Gombe 355 "
Coquilhatville 430 "
Mobeka 620 " Third Sector: Lisala 750 "
Basoko 940 "
Stanleyville 1070 " The first sector was opened to the traffic in July, 1920, the second sector was added to the first one in December of the same year and operation on the third sector was started only in June, 1921. The importance of this aerial route can hardly be over-estimated, since it opens up the center of Africa and enables colonial products to reach Antwerp a month earlier than would be possible with the ordinary means of transportation. With the establishment of this line in the Congo and with the establishment of lines of communication between Brussels and Paris and Brussels and London, operated by the S.N.E.T.A. which was created, as we have said before, by the Belgian Government for the purpose of creating a national manufacturing industry and a national commercial aviation, the Belgian Government has taken quite a decided step in the desired direction. The aeronautical budget for 1921 provided 10,000,000 francs for civil aviation developments and 12,000,000 francs for military aviation developments. A project for an aeronautical research laboratory was started in 1921, but up to the present time no material progress has been made towards the realization of that project.

Commercial Operation of Aerial Services

The S.N.E.T.A., during the summer of 1919, opened up three flying fields, one at Brussels, another at Antwerp and the third at Spa, from which passengers were taken for joy rides in the air in order to popularize the use of flying machines in Belgium. More than 4,000 passengers were taken up from the Brussels flying field; 1500 from Antwerp and about 200 from Spa, this being done for advertising purposes. At the same time, the service between Brussels and Paris and between Brussels and London was started in connection with the French and the English lines. The service has been quite regularly operated all through 1921, the passengers' rates being; Paris-Brussels or vice-versa, single trip 300 francs, round trip 450 francs. Between Brussels and London and vice-versa, single trip 450 francs, return trip, 800 francs. Each passenger is allowed to carry 15 kilograms of baggage free. Excess baggage being charged at the rate of 4.50 francs per kilogram each way. The fares quoted include automobile service between the flying grounds and the center of the town. The mail rates were, up to the time when the French rates were reduced, .75 centimes per 20 grams or fraction thereof up to 100 grams. Over 100 grams, 50c per twenty grams or per fraction of twenty grams. These rates being in addition to the ordinary postal charge. Since May, 1921, the rates have been brought down to the level shown in Table No. 7 in order to make them agree with the rates charged by the French mail service over the same line. The rates for express matter were previously 7.50 per kilogram up to 5 kilograms. From 5 to 10 kilograms, 6.50 per kilo; from 10 to 20, 5.50 per kilo; over 20, 4.50 francs per kilo, the minimum charge per parcel being 7.50 francs. The present express rates vary from 3.05 francs to 4.10 francs per kilo. These rates being in the same order as the rates charged by the French lines for the same service. On the Paris-London line, the rates were previously, up to 50 kilograms, 7 francs per kilo.; over 50 kilograms, 6 francs per kilo. The minimum charge being 10 francs per parcel.

The rates being at present the same as those charged for similar services by the British companies, namely 5.05 to 7.7 francs per kilo.

The service on these two lines has been just as satisfactory as the service of the French and the English companies operating on the same routes, and just as productive from a financial standpoint as the other two, the reasons being the same, namely: aeroplanes not well adapted to commercial services, large overhead expenses on the operation of these lines, due to a lack of sufficient business and due to the kind of flying equipment used. Also, in this case without the help of Government subsidies, the Belgium aerial lines could not have been self-supporting.

The S.N.E.T.A. has increased its capital invested for aerial transports to 4,000,000 francs. The headquarters of the S.N.E.T.A. are in the "Banque d'Outremer," Brussels, and is financed by a group of the most important Belgian banks. The directors of the S.N.E.T.A. have formed a new company, "The Societe Anonyme Belge de Constructions Aeronautiques," which is nominally separated from the aerial transport business, but it is financed by the same group and is really another branch of activity of the S.N.E.T.A. This company has signed a contract with the Belgian Government for the construction and repair of army aircraft, the Government guaranteeing a minimum sum of 6,000,000 francs worth of business per year. This guarantee by the Government quite evidently puts the company on solid ground right at the beginning, and the close association existing between the manufacturing end and the operating end of aircraft under the Government's control gives promise of good results for the future when the present crisis is past.

In the Belgian Congo, the establishment of the line between Kinshasa and Stanleyville has offered a number of difficulties due to the rather exceptional weather conditions prevailing in a tropical climate. The aeroplanes used were designed for carrying 900 pounds of commercial load at 90 miles per hour. The commercial load and the speed were actually found to be 75% of what was anticipated of them. This is due to the influence of the great variations in temperature taking effect on the parts coming in contact with the water, thus subjecting them to sudden contractions and expansions; these parts being made entirely of wood. These machines have a center of gravity relatively low and the influence of these contractions and expansions and the weight of the water added to the bottom of the machine when leaving the water greatly affect the longitudinal stability of the hydroplane when the motor stops. The motor used on this type of machine is the Renault 300 h.p., which apparently has given satisfactory service so far. The radiator has not given serious trouble, but it has been found that it is too small and the temperature of the water, 80° centigrade, is found to be excessive. The main trouble, however, has been experienced with the gluing together of the various wooden parts, which under the influence of the water, the humidity of the air, and the extreme variations in temperature, would not hold satisfactory, thus making flying in these machines, a rather dangerous proposition. It is estimated by the Belgians that for the colonial service they would have to adopt metallic aeroplanes.

In spite of the great national wealth of waterways in the Belgian Congo, only 1900 miles can be utilized for laying out aerial lines operated by hydroplanes. Of these 1900 miles, only 1070 miles are exploited at present on the line Kinshasa-Stanleyville, which is known as the "King Albert Line."

It is expected that in order to open up the aerial traffic in the Congo, the service must be operated by both hydro-

planes and aeroplanes. At the present time nothing has been done as yet, for starting an aeroplane service in the Congo. The aerial activities there being limited to the exploitation by hydroplanes which shall be further extended before the aeroplane service is started.

The transportation charges on the Belgian Congo lines are as follows:

Anything sent by mail is charged 3 francs per 20 grams or fraction of 20 grams for any distance.

Freight is charged at the rate of 15 francs per 500 grams, the minimum charge per parcel being 50 francs.

The passenger service is mainly limited to officials and employees of the Belgian Government. An ordinary passenger is only taken if the freight carried leaves room available. Passenger rates are in the order of four francs per mile. Passengers baggage is charged at the rate of 30 francs per kilo per each section or part of the section flown. (As we said before the complete route is divided into three sections.) The complete trip from one end of the line to the other costs about 4500 francs and this can be made in one day, whereas by boat, the same trip takes 18 days.

While I was in Belgium at the beginning of 1921, I was informed that the "Forminiere" (a mining enterprise, mainly financed by American capital and operated in the Belgian-Congo), had made an offer to the S.N.E.T.A. to pay 40,000 francs per trip per hydroplane carrying passengers and freight for them. From the time when the exploitation of the aerial lines in the Congo started, the following progress has been made:

From September to December 1920, Miles flown: 15,000; Mail carried, 1,600 lbs.

From January to August 1921, Miles flown: 25,000; Mail carried 2,000 lbs.

The greatest increase in the volume of business taking place in the last two months of the above named period of time, namely, June and July, when the weight of the mail carried was more than doubled.

The traffic on this Congo aerial line is mainly absorbed by Government business at the present time.

Conclusion

The city of Brussels, due to its geographical location is bound to be a rather important link in the international lines in Central Europe, and the Belgium Government is doing all it can to protect Belgian interests by helping to create a national aircraft manufacturing industry, which, unlike other nations, was stagnant during the war. The King of Belgium is taking a very keen interest in the development of aviation and all the royal family are using aeroplanes as an ordinary means of transportation for traveling from one point to another in Belgium and abroad. Belgium, as is well known, is a country where the engine manufacturing industry has always been highly developed. There is not the least doubt that the Belgians will soon be able to compete on the market with firms of other nations in the manufacture of aircrafts and aircraft engines. The exploitation of aerial lines in Belgian Congo, which is a very rich colony, will undoubtedly contribute greatly to the development of aerial flying in Africa, because it will compel other nations to use the same means of transportation in their African colonies, for meeting the competition of the Belgians, which by using aeroplanes and hydroplanes will enormously shorten the time needed for bringing their colonial products to the port of embarkation.

FIGHTING INSECTS WITH AEROPLANES

AIR machines will doubtless be used in the future for many other uses than we yet discovered for them, according to Mr. H. A. Goddard, State Entomologist, Wooster, Ohio, who contributes an interesting article to the Air Service News Letter on the above subject, giving a description of the dusting with arsenate of lead of a grove of catalpa trees, six acres in extent, at Troy, Ohio. This grove was defoliated by the catalpa sphinx caterpillar in June, and the second brood came in force early in August and were stripping the new crop of leaves from the trees when the dusting checked them on August 4th.

Mr. Gossard states that in France aeroplanes are being used as scout machines to discover the location of grasshopper swarms and then to scatter poisoned bait for the destruction of these insects. He then goes on to say that several months ago, the city entomologist of Cleveland, after experiencing great difficulty in spraying some closely planted large trees in one of the suburban parks constituting the grounds of an important and wealthy club, conceived the idea that such a tract could be dusted from an aeroplane. He communicated his idea to the Ohio Experiment Station and solicited our help. Mr. J. S. Houser, who for a long time has had

charge of our forestry entomology and who in past years had frequently co-operated with the City Entomologist, Mr. C. R. Nellie, was assigned to this project. By enlisting the help and interest of Ex-Secretary of War Honorable Newton E. Baker, arrangements were easily made to obtain the cooperation of the Military Air Service and every facility at McCook Field, Dayton, Ohio, was placed at our disposal. A hopper was designed by a specially detailed mechanic to carry about 200 pounds of arsenate of lead powder which could be emptied into the air by a series of revolving spoons operated by a

(Continued on page 67)

RESEARCH FROM THE DESIGNERS', CONSTRUCTORS' AND USERS' POINTS OF VIEW

By MAJOR FRED M. GREEN, O.B.E., M.I.C.E., F.R.Ae.S.

(Concluded from page 9)

RESEARCH FOR CONSTRUCTORS

Aeroplanes.

One of the most important processes with which the constructor is concerned is the joining of materials together, particularly the gluing of wood and the soldering, brazing, and welding of metals. There is still no waterproof glue that is altogether satisfactory and although much work has been done on the subject there is room for further research. The methods of soldering, brazing and welding have always been largely shop processes. There is little information to be had on the subject and as these three methods are constantly used by all aeroplane constructors further knowledge would be of advantage. Fluxes in particular call for attention, especially to determine which are easily useable and do not set up corrosion.

The manipulation of thin sheet metals seems to be so much a practical matter that it is difficult to suggest research. The present method is to leave it almost entirely to the skill of the sheet metal worker. The making of such things as metal propellers, spars and ribs for aeroplanes and the like present practical difficulties to the shops and it is possible that research might be instituted to determine how best to work materials to get them to their required shape and also in certain cases how to heat-treat them after work without causing deformation. The best method of preventing corrosion also needs investigation.

There is another peculiar problem which constantly presents itself to the aeroplane maker. It is to make stiff light forms of various shapes suitable for fairing which are weatherproof and if possible fireproof. No completely satisfactory method has yet been devised and it seems to me that an investigation on the subject might lead to useful results. In the general way the strength of these parts is unimportant, the chief requirement is that they shall keep their shape.

Engines.

The making of aeroplane engines presents a variety of problems in the shops. In the general way it is much easier to machine parts to the required degree of accuracy than to be certain that the material of which they are constructed is of the required strength and free from faults. The need for steels of uniform quality and of higher tensile strength has already been mentioned. The constructor is particularly concerned with the correct heat treatment of the material that he receives. It is not suggested that special research is needed in heat treatment as this is bound up with the production of more uniform and better steels; the question is chiefly one of great care both on the part of the steel maker, and the user.

In connection with the making of stampings, the flow of metal in the dies often has as great an influence on the strength of the stamping as the material itself. This again is hardly so much a matter for research as for direct experiment and the knowledge of the importance of using good methods.

Included in the heat treatment of metals must be case hardening, particularly of intricate parts. The life of most aero engine could be improved considerably if certain parts were specially hardened. This is not done on account of the difficulty of knowing that the hardening will be carried out in a manner which will not injure the rest of the part. Here I think is a large field for investigation, but again, it is of a practical rather than a theoretical nature.

The difficulty of obtaining light alloy castings has already been mentioned. This is certainly a question in which the engine maker is vitally interested, and any help from research will be gladly welcomed.

Research for the User.

The requirements of the user in the matter of research naturally apply to the actual operation of aeroplanes. Many of his problems would be removed or at least made easier by the researches already indicated, but certain of them are apt to be ignored both by the designer and the constructor. One of the most important of these is safety from fire both in flight and in case of accident. The paying load of an aeroplane is already small and consequently we cannot afford to expend much weight in rendering aeroplanes fireproof. There are, however, a number of precautions that can be taken

which involve little or no weight and further knowledge of this subject will help to remove one of the gravest risks connected with flying.

Safe landing in small aerodromes is likely always to be of interest to the user, who very naturally objects to paying more rent for his ground than is necessary for safety. The research already suggested in connection with control at low speeds is possibly the most important factor of landing in small aerodromes and probably more advantage will be gained by a knowledge of this subject than by the use of wings of an abnormally high lift coefficient. Landing gears in the general way offer possibilities of improvement, but this is rather a matter of individual design than of any particular research.

Lighting on Water.

There are many countries in which it is difficult, if not impossible, to find ground suitable for aerodromes, but where there is plenty of water which can be used for the purpose. In some cases it is convenient to have aeroplanes which can make use of either land or water for alighting and getting off. With the limited carrying capacity of an aeroplane, it is very doubtful whether amphibians will be of commercial use unless the conditions are particularly unsuitable for either land or water aeroplanes. We have a fair knowledge of properties of floats and hydroplane boats. There is no doubt that this knowledge might be extended by further research. In the construction of boats and floats we still have a lot to learn but this will probably have to be a matter of direct experiment.

The user is much interested in the comfort of his passengers, and in this matter the silencing of the engine and of the airscrew is of importance. The silencing of engines is fairly well understood but involves in general a rather heavy expenditure of weight. The silencing of airscrews is more difficult and perhaps the problem could better be solved by placing the passengers in cabins which are more or less soundproof. The subject is one on which little is known and research might indicate methods of improvement.

In common with the designer, the user is interested in the question of stability and control. The research he needs is much the same as that already suggested for the designer, particularly control at low speeds. He is also interested, though I think to a very minor extent, in the use of parachutes. My personal opinion is that he is chiefly interested in not being compelled by law to carry parachutes, and in order to achieve this end, we must endeavor to make our aeroplanes so safe that the probability of needing parachutes becomes negligible.

Meteorology.

The user is interested in weather prediction, more especially in anything that will affect visibility, such as fog and snow. He also wishes to have reasonable warning of dangerous extremes of weather, particularly in countries which are liable to violent storms.

He is also interested in knowing the direction and strength of the wind at various heights, so that he may economize time and money by taking advantage of favoring air currents and in avoiding those which are unfavorable. This cannot be done to any extent until the pilot is enabled to choose the height at which he can fly and need not be troubled by the risk of either a forced landing by flying too low or of getting lost when flying above the clouds.

Navigation.

The question of navigation presents no difficulties so long as the visibility is good. There are many reasons why it is not convenient to fly always in sight of the ground. When the wind is favorable it will generally pay to fly high and it is certainly more pleasant to be in the sunshine above the clouds where the air is almost always steady, than to be tossing about just beneath them. In addition to this, the economical speed of the aeroplane is greater higher up where the air is less dense than it is near the ground. We need therefore special arrangements on all established air routes to ensure that the pilot can easily find his way when above or in the clouds or when flying in foggy weather.

There are many ways in which wireless telegraphy and telephony can help, but it is essential that the gear carried

on the aeroplane shall be as light and as simple to use as possible. There seems to be no reason why a pilot should not be able to ply from place to place blindfold with as great a certainty as he now does keeping in sight of the ground. The important thing to do is to convince the pilot himself that the gear with which he is provided is absolutely reliable. Until he is confident of this, he will always be chary about losing sight of the ground.

Wireless control of the airplane itself from the ground is certainly a possibility of the future and it may be that the pilot of an air liner will give up the control of the aeroplane when within a certain distance of his landing place to a ground pilot who will bring the aeroplane into port. It is permissible to look forward to a time when this method of control will be developed so that aeroplanes can be landed in their aerodromes with certainty at night or in dense fogs.

Multi-Motor Aeroplanes.

In running an air service it is essential that forced landings of any sort shall be as infrequent as possible. If we could absolutely cut out the chance of motor failure we should absolutely achieve this end. Aeroplanes have been made in which the power unit has been divided up into any number of motors up to six, but for many reasons the single motor aeroplane is still in practice as reliable as the multi-engine machine. Various attempts at solutions have been made either by running the engines as separate units or by coupling them together by means of gearing. No solution can yet be considered as entirely successful. There is certainly room for research in this direction and it will probably need close co-operation between the engine designer and the aeroplane designer if a solution is to be found.

Conclusion.

No one disputes in general the value of research, but the practical man is apt to be impatient with the research worker and to complain that the results submitted to him are not sufficiently positive and clear cut to be of much value. The research worker on the other hand frequently imagines that the designer is not taking advantage of his work in that he does not immediately improve his designs by applying the information given to him. The difficulty with the practical man is that the results of research are given in such a form that they are not easily understood by him and for the sake of scientific accuracy the reports are sometimes so guarded and hedged around with conditions that the practical man will not believe them. At the same time we can only make real progress by acquiring a knowledge of the subject which becomes gradually more and more complete. Organized research and experiment and the free discussion of results are the only methods likely to lead to this result. The high position that this country holds in the development of flying is I think due almost entirely to the wisdom of the Government that set up an Advisory Committee and instituted research work at the very beginning of flying. The work carried out at the National Physical Laboratory, the Royal Aircraft Establishment and Testing Stations of the Royal Air Force could not possibly be done by private enterprise, and it is by the information gained and the standard set by this work that the industry is enabled to produce aeroplanes which cannot be rivalled in any other country.

It is the opinion of the writer that help of this kind is of greater value than direct subsidy and he earnestly hopes that even the pressing need for economy will not prevent research being carried out in the future in the same spirit as it has been carried out in the past.

RESEARCH UNIVERSITY AT WASHINGTON, D. C., GIVING TRAINING IN AVIATION

By LESTER DRAPER SEYMOUR

Consulting Aeronautical Engineer; Information Group U. S. Air Service, and Professor of Aeroplane Engines

BY providing residence classes in the evening after four-thirty, the Government closing hour, and correspondence instruction, Research University, at Washington, D. C., has this year been meeting the increasing demand for skilled instruction in the aeroplane business. Students in all parts of the country and at the national capital are studying Aeroplane Engines, Aeroplane Construction and Navigation, Aerodynamics, and other similar studies under the guidance of leading aeronautical experts in the Government service.

Not only the usual information in aeronautics, but the latest data resulting from recent tests and experiments by the Army, Navy, and Post Office Departments is made available. Each of these departments has signified its willingness to assist whenever possible in furnishing up-to-the-minute material and cooperating to the end that the School of Aeronautics of Research University may secure every facility allowable under the customs of the service in its effort to advance the art of aeronautics. Just what this means is more obvious when one realizes that at the nation's capital is centralized the world's available information on this new and most promising science and art.

Young men are taking the University courses in this field as a fundamental basis for aeronautical work, because they realize that the possibilities of air transportation are very great and that, in the near future, developments are sure to offer excellent opportunities to those who are equipped to take advantage of them. Commercial aviation is now a virginal field with as great attractions to young men and the nation as ever railroads, steam-

ships, or other means of transportation offered in the past. The great railroad systems of the country as well as the steamship lines were built and planned by men who could see beyond their immediate surroundings with a vision that embraced transportation problems of an ever-increasing and progressing nation.

The present seeming apathy on the part of some of the large financial interests in this country, relative to the development of aerial transportation, air routes, and commercial aeronautics in general, is of no more significance than was the attitude which such interests took toward the early steamboats and railroad trains. The aeroplane has demonstrated its efficiency. The pioneer work of the Wright brothers has come to fruition in the success of the aeroplane in the world war, in the ability of planes to sink superdreadnaughts in a few minutes—as demonstrated off the Virginia Capes—and in the success of the United States Post Office in conducting, month in and month out, successful air-mail delivery entirely across the continent.

The men who are now able to see and appreciate these possibilities realize that when they go into aviation, and when they make themselves fundamentally prepared in the scientific aspects of the art, they are not entering a "blind-alley" profession—that the training in construction, aerodynamics, flight, and engines can be transferred largely to the automobile industry if necessary, and each month will bring the individual so trained into greater prominence and give him a better opportunity to meet an important national need.

Research University is a cooperative institution of higher learning, organized

on a non-profit basis by leading educational and other experts of the national capital. It provides high-class instruction to day and night workers and those in the field in as great variety of subjects as are the needs of federal employees and others.

Influence of Model Surface and Air Flow Texture on Resistance of Aerodynamic Bodies

This report by A. F. Zahm is an analysis of the resistance equation

$$D = \rho L^2 V^2 f \left(\frac{V}{v}, \frac{L}{L_g} \right) \quad (VL)$$

It is shown that the expression $f \left(\frac{V}{v}, \frac{L}{L_g} \right)$ applies only to a special case of uniform air flow and model surface texture. In order to obtain comparable results under various conditions it is necessary to use a more general form of the resistance equation, such as

$$D = \rho L^2 V^2 f \left(\frac{V}{v}, \frac{L}{L_g}, \frac{V}{V_a}, \frac{V}{V_L} \right)$$

in which $\frac{L}{L_g}$ is a measure of the model surface texture, and $\frac{V}{V_a}$ a measure of the air

flow texture. These two functions have particular application in the comparison of tests from different aerodynamical laboratories.

A copy of Report No. 139 may be obtained upon request from the National Advisory Committee for Aeronautics.

NAVAL *and* MILITARY AERONAUTICS

Radio Recruiting Publicity

Mitchel Field has been actively engaged in recruiting for some time, but the past week saw the most novel experiment in Air Service recruiting publicity yet tried out. The following message was broadcasted by means of the radiophone:

"This is BM5, the United States Army Air Service Radiophone station at Mitchel Field, Garden City, Long Island, New York. Opportunity in the form of an enlistment in the United States Army is knocking at the door of many men tonight thru the instance of the radiophone. The Air Service at Mitchel Field is sending out its call broadcast for men of good character between the ages of eighteen and thirty-five; to men who make the most of an opportunity to learn a trade, to develop their character and to improve their physique. Two hundred such men are needed at once at Mitchel Field to learn the specialized work of the Air Service; to become expert in one or more of the twenty odd trades that comprise aviation,—trades which in turn are more or less allied with the motor car, thereby offering an opportunity for employment in two or more important industries in civil life upon the completion of a three-year enlistment. Interest in a man's work is the greatest single factor in his happiness and efficiency, and with this fact in mind each man in the Air Service is given work for which he is best fitted. Congenial work is work that is commenced with interest and completed with success. Travel in itself is an education, and at the present time two aviation squadrons are forming at Mitchel Field for duty in Panama. There the work of the Air Service will be carried on identically as it is here, and those men who enlist for these squadrons will truly have the opportunity to earn, learn and travel. The Air Service of the United States Army today is looking for men who will meet it halfway, men who will make the most of opportunities offered and become of value to the service, thereby fitting themselves for promotion in the Air Service, and remunerative employment in civil life in the event that they do not reenlist. Men who are listening—by that fact—demonstrate their interest in radio work. The United States Army today is probably the biggest single exponent of the radiophone, and the Air Service offers practically unlimited opportunities to learn this interesting work from every angle. With its present increasing popularity, no one can forecast the vastness of its future, but it is safe to say that in the next few years there will be an opportunity for the trained man in this field of endeavor that will be comparable to the early days of the motor car. The Air Service today presents its strongest appeal to the young man mechanically and electrically inclined but, who thru lack of experience, is unable to fill a position in a commercial shop. One enlistment in the Air Service well spent will fit that man to hold his own in any trade that he may have followed in the service. If you think that you have the qualifications and desire to join the Air Service you should apply to the Recruiting Officer, Army

Building, 39 Whitehall Street, New York City, for further information, or better still, come out to Mitchel Field and see an aviation field in actual operation and have the Post Recruiting Officer go into the matter with you in detail. Who knows but what this may be the very opportunity you are waiting for."

Thus it was possible for everyone for miles around and ships far out at sea to hear Mitchel Field's call for two hundred men. After sending out the above call, the field is now determined to back up every statement made, in order that men reporting to this station for enlistment will not be disappointed in their desire to learn a technical trade to which they may turn upon going back to civil life.

Winter Sports At Bolling Field

During the slack flying days accompanying the recent deep snow, flying was kept up to a certain extent by fitting a "Jennie" and a Fokker with landing skids or skis. These were suggested and roughly designed by Major Scanlon, Commanding Officer, and worked out, completed and fitted by the Engineering Department. They proved entirely practicable on either hard or soft snow and were pronounced the best ever seen by all who observed them. Specifications, photographs and blueprints of same are being assembled for submission to McCook Field. Diversion during this period was created by a volley ball game in the deep snow by the officers, who wore bathing suits and were barefooted. Then the "Jennie" with a toboggan hitched on the rear was taxied around the field and furnished thrills for the fair occupants of the toboggan.

Duplex Radio Equipment Installed in Airplane

One of the aeroplanes of the 90th Squadron at Kelly Field has been specially equipped with radio, transmitting and receiving, together with an SCR-72 amplifier. Two generators are used with a special change-over switch, which eliminates several articles as regularly installed with the service SCR-73 set. Two antennae are used, one for the transmitting set and one for receiving, the system being known as duplex radio by which transmitting and receiving can be carried on at the same instant. The ship has been tested with the new high power radiophone of the First Wing, with good results, although it has not been possible to make distance tests as yet. The ship is the only one of its kind in the Eighth Corps Area at present. Radio music has been successfully transmitted from the ground to the ship at four thousand feet.

Helium Plant Closed Down

According to a special despatch to the New York *World*, the helium plant a few miles from Fort Worth built by the Government at a cost of \$7,000,000 to extract helium from the natural gas piped down from the Petrolia fields has been shut down because funds for its operation have been exhausted. The plant is in charge of Lieut. Commander Allan G. Olson and a guard of twenty men. It is the

only plant of its kind in the world. This country controls the helium monopoly. The visible supply has been estimated at only twenty years' duration.

Hydrogen, the other form of gas for inflating balloons, has been proven almost useless for war purposes, as a shell or bullet will explode it.

Helium is one of the rarest of gases known to science. It is derived from two sources—one from volcanoes, the other from natural gas found in certain sections of Texas, Oklahoma and Ohio, with minor deposits in some parts of Europe. It is next to the lightest substance known, the lightest being hydrogen. Although twice as heavy as hydrogen, helium has almost the same lifting power. Tests have shown that 1,000 cubic feet of hydrogen will lift 75.1 pounds; the same amount of helium will lift 69.59 pounds. But helium has the important advantage of being non-inflammable. It cannot be ignited by any means, and therefore is the ideal gas for balloons.

As the natural gas piped from the Petrolia fields comes into the helium plant it is first run through lime, which removes the carbon dioxide; next it is subjected to very low temperature, which causes the gas to turn to liquid, leaving only nitrogen and helium. Still lower temperature is then applied and only the helium is left, which is then drawn off and compressed into long slim cylinders or bottles for shipment.

None of the gas so used is wasted, as the process restores the liquefied gas not used and it is turned back into the mains for use of the Fort Worth consumers. The pipe line to the helium plant alone takes 15 per cent. of the gas produced at the Petrolia field.

Lighter than air ships of the American service which would benefit from the production of helium are of several types. They are, first, the small training ships in the Class B series, which require from 84,000 to 95,000 cubic feet of gas; next come the Class C ships, with a capacity of 181,000 cubic feet, and lastly, the great dirigibles, which need around 3,000,000 cubic feet.

The present cost of producing helium gas deterred Congress from making further appropriations for its manufacture here. Recent estimates put the cost of making 3,500,000 cubic feet of helium gas at \$300,000, or just enough to fill a ship of the Roma type once; and such a ship, it is stated, requires three fillings a year—\$900,000 a year. It would require three months' work at the Fort Worth helium plant to fill one ship of the Z or Roma type once. The plant was in operation for five months and during that time produced about 2,000,000 cubic feet. About 20,000,000 cubic feet is in storage throughout the United States.

Representative Fritz Lanham of this district and Senators Sheppard and Culberson and Representative Marvin Jones of the Amarillo district have joined forces in attempting to induce Congress to make the appropriation. It is understood that President Harding and the Cabinet are in favor of resumption.



FOREIGN NEWS



Lloyd's and Aviation.

Those who are closely concerned with Commercial Aviation would do well to make a practice of reading *Lloyd's List*, which is published daily at the price of 4d. That wonderful organisation which is known as *Lloyd's* is becoming closely concerned with Civil Aviation and will certainly become more so when the present Department of Civil Aviation is abolished or is reorganised under more capable control.

Meanwhile, *Lloyd's List*, which is the official organ of *Lloyd's* so to speak, is now publishing every Monday some three columns of very sound matter concerning aviation, generally written from the business man's point of view, and in such a manner as to cause interest among those who are not as yet directly concerned with aviation. Apart from this, any special incidents such as the recent Air Conference are treated fully in the *List* and if anything of an apparently interesting nature occurs in aviation it is recorded whatever the day of the week. Furthermore, any papers of aeronautical interest such as those read before the technical associations concerned with aeronautics received attention to the extent of a column or even more.

Official Opening of the R.A.F. Club.

On February 24th the Duke of York, accompanied by Wing-Comdr. Louis Greig, officially opened the Royal Air Force Club. He was received by Brig-Gen. R. H. More, the Chairman, Lord Cowdray, Air-Marshall Sir Hugh Trenchard and members of the committee.

The Duke made a tour of inspection of the new premises, including the kitchens, the rackets courts and the ball-room, and at the conclusion of the inspection Lord Cowdray handed to his Royal Highness a box containing the deed of gift of the Club, which Lord Cowdray has presented to the R.A.F. After declaring the Club open, the Duke handed the deed to General More, representing the trustees, and on behalf of the officers of the Force expressed their great appreciation of Lord Cowdray's generosity.

French Air Mail Fees Cut in Half

The Surtax in France on letters sent by air mail from Paris to London has been reduced from 50 centimes to 25.

An Air Service in Queensland

Arrangements are reported from Queensland for the opening of an air service between Cloncurry and Charleville, a distance of 570 miles, with a 250 miles extension to Mungindi, a railhead on the New South Wales border. Both passengers and mails are to be carried.

Death of Levvasseur

It is with sincere regret that we have to announce this week the death, on February 23, of Monsieur Levvasseur at the age of 58, after a brief illness. M. Levvasseur was interested in aviation from the earliest days, and it was his designing genius which created the beautiful Antoinette monoplane with Antoinette engine on which the late M. Latham won fame in and after 1907. Recently M. Levvasseur came prominently before the public in connection with his variable area aeroplane, which was acquired by the French Government. It is stated that, like so many pioneers, M. Levvasseur died a poor man, having spent his whole fortune on experiments in connection with flying.

British Mileage

In response to a question in the House of Commons, Captain Guest, Secretary of State for Air, gave the following information concerning service air mileage: "For 1921 the total mileage flown by service aircraft was, approximately, 5 million miles, of which 53 per cent. was flown in the British Isles and 47 per cent. overseas. I cannot give figures for the various types."

British Planes in Service

Mr. Malone asked the Secretary of State for Air in the House of Commons recently, the numbers and types of aircraft (landplanes and seaplanes) in flying trim now in possession of the Air Ministry, and showing how many are situated in the British Isles?

Captain Guest: There are 1,938 machines on the establishment of the Royal Air Force, of which 773 are actually in active use in squadrons and training units, and are supposed to be serviceable. The remainder are held as reserve. Of the 773 in active use, about 70 to 75 per cent. may be reckoned upon as serviceable, that is, in flying trim; but the number varies, of course very considerably, from day to day and from hour to hour.

The types are as follows:—Snipe, Avro, Bristol Fighter, D.H.9A., D.H.10, Vickers Vimy, F.2A and F.5., Vickers Ambulance, Vickers Vernon, Fairey 3 D., Fairey 3 C., Westland Walrus, Sopwith Cuckoo, Panther, and Sopwith Camel.

British Seaplane Floating Dock Tests

Built under arrangement with the Admiralty at Sheerness Dockyard, the Seaplane Floating Dock, designed for the Royal Air Force, and floated on September 4 last year, has been subjected to trials off Sheerness before being handed over to the Air Ministry. The tests included towing trials and anchor trials, and the dock was also submerged, a seaplane being docked on the pontoon. The tests were satisfactory in every respect, and the dock was towed back to Sheerness yard to be completed for delivery. The dock is fitted for the reception of two seaplanes of the latest type. The trials were under the superintendence of representatives of the Admiralty and Royal Air Force, and were conducted by officials of Sheerness Dockyard.

A Growing Air Station

France is gradually turning the port of Antibes into an important air station, and it is hoped to establish air lines running to Corsica, Sardinia and Tunis, using Antibes as the French terminus. On October 18 a seaplane flew from Antibes to Corsica (Ajaccio) in three hours ten minutes, which is a very great saving of time as compared with the time taken by steamer.

Italy's Great Trophy

We are just in receipt, from Lt. Colonel A. Guidoni, of the following regulations which will govern the competition for Italy's great trophy.

Art. 1.—In order to promote the development of the aeronautical

construction of commercial character, the Ministry of War creates a trophy called "ITALY'S GREAT TROPHY," valued at Lire 30,000.

It will constitute an International Challenge open to all aircrafts of Class C, and will be contested according to the conditions established in the following articles.

The following prizes are also awarded annually: 1st prize, Lire 150,000; 2d prize, Lire 50,000.

Art. 2. The trophy will be awarded to the winner of the first prize.

Art. 3. The trophy will be contested for three successive years at the time assigned in the detailed regulations.

Art. 4. The National Federation recognized by the International Federation of Aeronautics (I. F. of A.) in which the winner of the trophy is entered will temporarily hold the trophy until the successive assignment.

The trophy will then be definitely awarded to the firm that has won it twice, or if that is not the case it will be awarded to the winner of the third year.

In case the winner of the second year is the same of the previous year the contest is out.

If the second prize is not assigned the relative amount will be awarded to the winner of the first prize.

If in the second year the race is deserted and if no one is winner, the trophy (together with the prizes) will not be distributed to anyone, and will continue to remain with the Federation by which it was won the previous year. But for this reason, this Federation cannot be considered as winner also for the second time.

Art. 5. Every year before the first of January the Aero Club of Italy will publish the detailed rules according to that of the General Regulations of the I. F. of A., taking in consideration the progress of aviation.

The Aero Club will also appoint the jury for the distribution of the prizes and trophy; in this two experts, appointed by the Ministry of War, (Superior Command of Aeronautics) should take part.

Art. 6. Only aeroplane constructors may enter the race, through their respective National Federations.

Each firm may enter with not more than two aeroplanes and each Federation may enter not more than three firms.

The application must be forwarded annually to the Aero Club of Italy not later than May 31st.

Each application must be accompanied by the sum of Lire 1,000 for each aeroplane entered.

Lire 500 will be reimbursed for each aeroplane that has passed the starting point.

Art. 7. The trophy will be contested for in Italy, on a covered distance of 2,000 Km. in an enclosed circuit.

The 2,000 Km. may be reached even by covering a smaller circuit more times provided this circuit will not be less than 500 Km.

The distance covered must be accomplished in the following manner:

(a.) It is necessary that three intermediate landings be made (not including the return to the starting camp).

(b.) At least one of the landings (including the return to the starting field) must be made at night, that is three hours after sunset (local hour) or else two hours before sunrise (local hour).

(c.) An exchange of aeroplane will not be allowed, neither the exchange of the motor, but the exchange of the pilot will be permitted.

(d.) Only three supplies of fuel will be allowed (not including that at the start).

(e.) The aeroplanes must have the capacity to carry a commercial load of at least 250 Kg. intending for the commercial load the total useful load, minus the weight of the pilot or of a pilot, in case the aeroplane should be at a double command, of fuel and oil, instruments. The weight of each pilot will always be figured at 80 Kg.

(f.) All the aeroplanes will have to be equipped with tachometer, clock, gauges, altimeter, compass, speedometer and turn indicator.

(g.) Before the starting all the aeroplanes must demonstrate in an eliminatory race to possess a minimum speed of not more than 80 Km. per hour.

(h.) The starting must be effected with the full load.

(i.) The radiotelegraph apparatus put on board will be considered as being part of the commercial load.

Art. 8. Only those that have completed the entire distance established in Art. 7 will be classed.

The classification of the prizes will be made by multiplying the commercial speed reached in the total covered distance by the commercial load transported divided by the fuel and oil consumption per hour. It is intended, for commercial speed, the covered distance divided by the time employed from the first start to the last landing; for a commercial load that defined in paragraph e of Art. 7; and the fuel and oil consumption per hour the total consumption of fuel and oil divided by the total time in which the aeroplane has been effectively in the air.

To the firm who has reached the highest factor the first prize will be awarded and the Trophy; the second prize will be awarded to the firm that has immediately reached the successive quotient. If the same figures show for two or more contestants, will constitute a point of merit the best and more rational of installation of the instruments of navigation, according to non-appealable decision of the jury.

Art. 9. The Ministry of War reserves the right to buy the Italian aeroplane or aeroplanes that have shown themselves being worth particular attention in the race, thus up to an amount of Lire 200,000.

Art. 10. The competitors and the pilots entrusted to the conduct of the aeroplanes must be of the same nationality of the Federation that enrolls them, exceptions made for those countries that are not affiliated with the I. F. of A.

Art. 11. The Military Administration does not assume the responsibility other than that of awarding the Trophy and to pay the prizes to those firms that have been judged winners by the Jury. The said Administration will not participate to the disputes that may arise eventually in regard to the adjudication of the Trophy and prizes and will assume no responsibility whatever. Also the Administration will not assume any responsibility for any damages that may possibly derive either to the competing firms, or to thirds, in dependence or in occasion of the race that is subject to the present regulations.

Art. 12. The detailed Regulations will also point out all the clauses of Customs and Administrative character.

ELEMENTARY AERONAUTICS and MODEL NOTES

The Hansen Compressed Air Model

RAYMOND C. HANSEN, Secretary of the Pacific Model Aero Club, San Francisco, is the designer and builder of the compressed air driven model illustrated below. Mr. Hansen's drawing shows the plan view to scale, from which it is possible to gather a comprehensive idea of its graceful proportions and simplicity of design.

Weather conditions prevented more complete tests being made, but the results already obtained serve to show its capabilities. Powered with a three-cylinder rotary type compressed air engine, this monoplane with a wing-spread of nearly five feet has flown distances up to 600 feet at altitudes averaging 150 feet high. This performance is for a "hand-launched" flight. Rising from the ground under its own power, the model flies 150 to 200 feet. The duration varies from 15 to 40 seconds. Altitude is gained very rapidly.

The designer suggests that if a powerful engine is used by those building such a model as this, that the wing area be decreased somewhat, and that a longer tank be used; or, better still, a tank larger in diameter, because the weight increases more with the same volume of air for the longer tank. The shorter tank also keeps the tank weight more concentrated and is less disturbing to the fore-and-aft balance of the model.

Owing to the light loading per square foot of surface, the No. 3 E model is not suitable for flights in windy weather. On a day of normal wind, however, flights are made with good results.

In spite of the light loading of the wings and the high aspect ratio, the model flies with considerable speed. This is due, no doubt, to the feathered trailing edge which allows the air pressure to lift it, thereby flattening out the wing curve a little

at high speed and allowing it to spring gradually back to normal as the engine power decreases. As a result of the flexible wings, the model has a relatively slow landing speed.

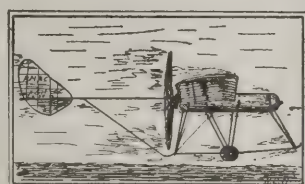
The wing curve is a modified Eiffel 32. As the center of pressure due to the reflex angle of the trailing edge does not travel much, good longitudinal stability is maintained at all times during flight. Lateral stability is insured by ample dihedral angle.

Landing shocks are accommodated by using small steel compression springs slipped over the piano wire chassis rear members, soldered to the end of the spring nearest the wheels. The members then pass through a length of brass tube, which in turn is soldered to the tank. A ball of solder is put at the tip of the piano wire member to keep it from being pulled through the tube by the spring. The two front chassis members are put in tubes attached rigidly to the tank.

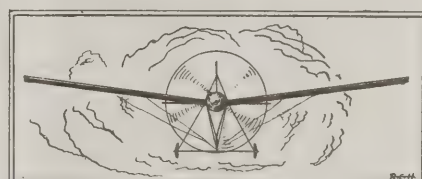
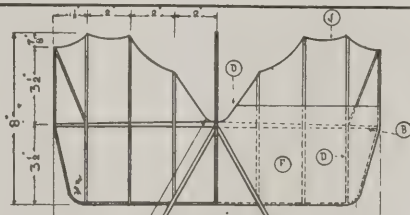
Small sockets of brass tube are soldered in place on the tank to receive the wing beams. For fastening, one end of a piece of piano wire is bent at right angles and attached to the wing beams, while the other end is slipped into the tube socket. Wing beams are attached in such a way as to require no "drift" wire braces to the nose.

The king-post method of wing bracing is used. Wing panels are set with an incidence angle of 4 degrees.

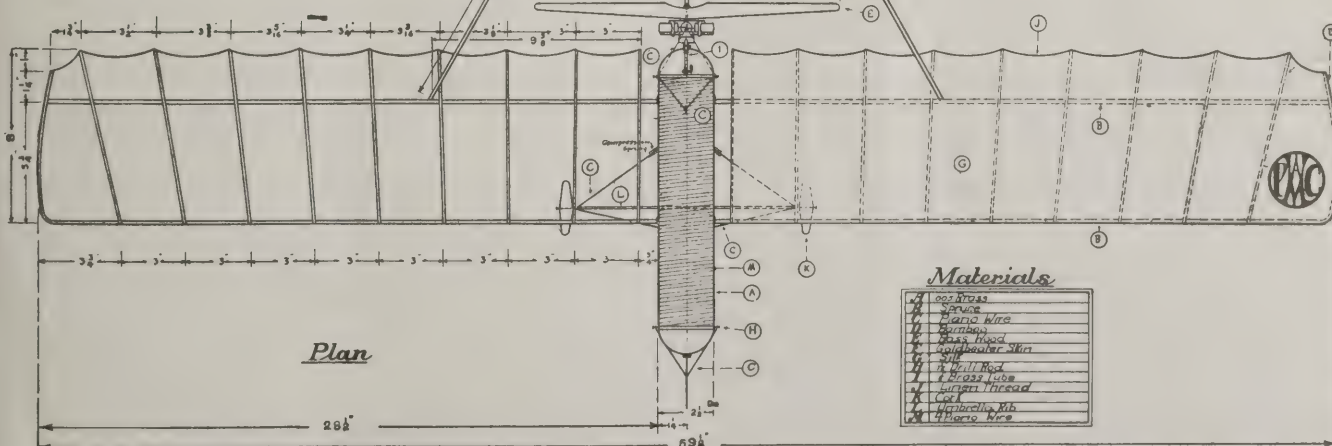
The engine, a 3-cylinder rotary, is run on an air pressure of 50 pounds. Cylinders have a bore of $\frac{3}{8}$ inch and a stroke of $\frac{5}{16}$ inch. Pistons are capped with leather cup washers. No data is available on the weight and power, but the engine is considered quite light and capable of developing good power with fairly low consumption of air. Once the engine starts, it is not possible to stop it by gripping the propeller shaft between the fingers.



Scale of Inches

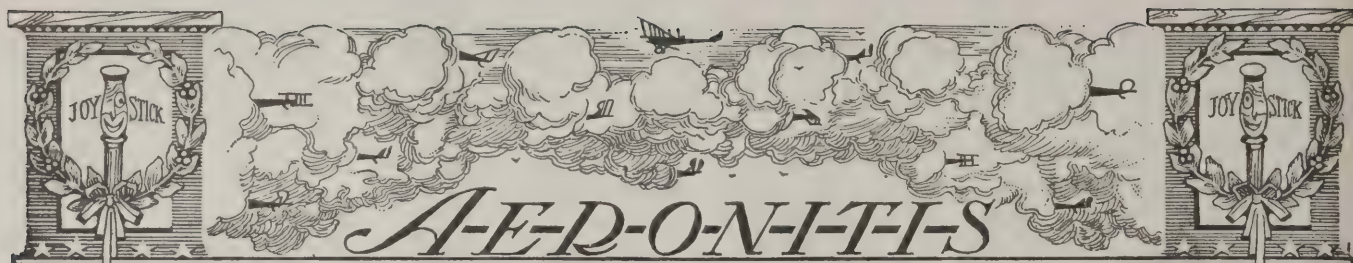


HANSEN No. 3 E COMPRESSED AIR MODEL



Materials

1	1/8" Brass
2	1/8" Spring
3	1/8" Wire
4	1/8" Brass
5	1/8" Brass
6	1/8" Brass
7	1/8" Brass
8	1/8" Brass
9	1/8" Brass
10	1/8" Brass
11	1/8" Brass
12	1/8" Brass
13	1/8" Brass
14	1/8" Brass
15	1/8" Brass
16	1/8" Brass
17	1/8" Brass
18	1/8" Brass
19	1/8" Brass
20	1/8" Brass



The Ship of the U. S. Mail

The ship of the U. S. mail,
Daily I see you set sail,
Throughout the sky and azure blue,
To a port built for you.
Across the country on stalwart wing,
Messages of love and business bring,
To cheer a heart, good luck impart,
With the speed of the archers dart.

I like to hear the roaring din,
Of Liberty twelve when she comes in,
No music rare does compare
With the ship sailing there.
How oft I have wished for a trip,
In Uncle Sam's own mail ship.
Sail on through the azure blue
Free from care, with naught to do

Each day I have looked for you,
Away off in the azure blue
Watched you ride with majestic pride
Wind and weather on your side.
By you I set my mantle clock,
Thus all errors do I mock.
Right on time you come in prime
With never, never a weary sign.

Bravest of pilots day after day
Take you across the spreading way,
With love and pride they hold the lane,
Until they bring you in again,
So goes the days, so comes a year,
Time and again you bring good cheer,
In snow or rain you come again
Like the sun and planet main.

Some day perhaps, perhaps by chance,
Some pilot in a friendly trance,
Will retire my one desire,
To ride me until I tire.
Up to a world of mine own,
There to think and think alone,
Amid the roar and din, sail,
In the ship of the U. S. Mail.

Hi Bacon.

A Matter of Gas

Molly was out riding with the preacher.
"Where shall we go?" said the preacher.
"Don't know. Where do you want to go?"
"To heaven," said the preacher.
"Do you think you have gasoline enough?" asked Molly.
—*Judge.*

Rare One

I once knew a girl who was so modest that she wouldn't even do improper fractions.
We knew a dame who was so bloomin' bashful that she couldn't look bare facts in the face without blushing.

Father (Reading letter from son at college to his mother)—
Myopia states that he's got a beautiful lamp from boxing.
Mother—I just knew he'd win something in his athletics.
—*Orange Owl.*

Gone Too Far

"I guess Jake's in bad with Marion's old man for fair, this time."
"Why?"
"Well, he was up to her house the other night, and the old man asked him if he was a pretty steady sort of fellow."
"And Jake said that he sure did hope so, because he'd spent enough on Marion already for it to be anything but permanent."

Sweet Rosie O'Grady
She was a blacksmith by birth
She was tired of living,
She wanted to leave this earth,
She wanted to die by inches,
But dying by inches was hard,
So she went out in our ally,
Laid down and died by the yard.

Mother—"How would you like a little sister, son?"
Son—"Like Papa's stenographer?"
Mother—"Why son, what do you mean?"
Son—"Well, I heard Papa call her his little girl the other day."

Finishing the Job

Husband—"Who was that man you were kissing when I came up on the porch?"
Wife—"Really, John, he is a perfect picture of my brother and I kissed him before I knew it."
Husband—"I didn't know you had a brother."
Wife—"I had one but he's dead now."
Husband—"Well if I catch that fellow around here again I'll complete that perfect picture of your brother."

The Flight in Luxemburg

One Hundred years ago, in Luxemburg,
There was a Man that flew.
Using naught but one man power,
And only two wings too.

* * *

At night over tree and house tops he'd fly,
When all was dead and still.
Never would he fly in day light,
This Man of Aero skill.

* * *

The people in the village, where he lived,
Were awful religious.
They said this man was the devil,
As say superstitious.

* * *

This Man would fly, for hours and hours,
And yell to scare these folks.
They prayed like hell 'cause they were scared,
He thought it was a hoax.

* * *

The simple folks went to the priest for help,
He to the forester.
This Man that flew made one mistake,
Took with him a glistler.

* * *

He would swing this light around and around,
While on his nightly flight.
The folks said 't was the light of hell,
And then one dreary night.

* * *

The priest blessed bullets, the forester, watched,
And whiz a bullet sped.
To the heart of this inventor,
And the poor Man dropped dead.

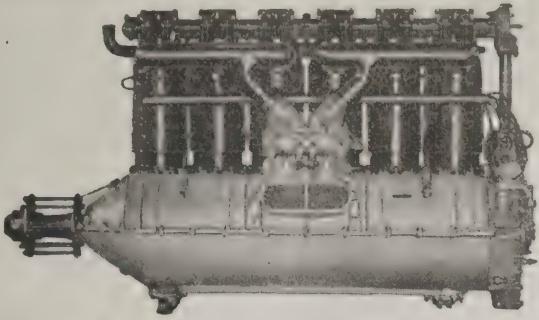
H. Theo. Haller.

Hot Dam Chollie

Horace: To me you are the breath of life.
Doris: Let's see how long you can hold your breath.—*The Juggler.*

Accuracy

Editor—Are you the chump who wrote about the dance Friday?
Reporter—Yes.
Editor—Well, look at this, "Among the prettiest girls in the room was Frank Newman." Nice rubbish, that is. Don't you know that Frank is a boy?
Reporter—Sure, but that's where he was.—*Lehigh Burr.*



World Famed Motors AT FAR BELOW COST

We have purchased the stock of airplane motors received by the Government as its share in the division of spoils by the Allies, including Fiats, Isotta Fraschinis, Beardmores, Mercedes, and Benz, as well as a large stock of replacement parts.

We are offering these as they are, or rebuilt and equipped for marine service; and at prices that are extraordinarily low—prices that would be impossible under any other circumstances.

Either for air or marine service, they represent a wonderful opportunity.

Send for Catalog and Prices

DETROIT MARINE-AERO ENGINE CO.

4198 Bellevue Ave., Detroit, Michigan
721 E. 135th St., New York

(Continued from page 60)

hand crank. The hopper was attached to the side of the plane somewhat lower and behind the occupants of the cockpits so they would not breathe any of the dust. Besides the pilot another man was needed to turn the crank. The propeller and current created by the movement of the machine, assisted by gravitation, distributed the dust, which was caught by the wind and carried through the tops of the trees.

The opportunity for testing the aeroplane idea was afforded by the grove of catalpas above mentioned. Six passes by the grove were made by the aeroplane, but in general practice we believe only one or two will be necessary. The time during which dust was spilling from the hopper was 54 seconds. The aeroplane passed about 50 feet out from one side of the grove and 20 to 30 feet above the tops of the trees. A strong wind carried the dust over the entire grove, nearly 400 feet wide, and it could be found in easily perceptible quantities on weeds and grass for 150 feet in the pasture on the distant side of the grove. Effective dusting was, therefore, done over a width of about 600 feet, or at the rate of about 10 acres per minute, and since the passes can be reduced with perfected apparatus from 6 to 2, a normal rate of application may be expected to be about 30 acres per minute. Within 3 days after the application, 99 percent of the caterpillars were dead and were strewn on the ground, hanging from the trunks and limbs, making the grove indescribably foul and repulsive. I feel sure that one airplane can dust a strip of forest or of pecan orchard in less time than 20 of the most powerful liquid spraying machines can cover it.

The problem is to perfect dusting materials so they will give results compar-

able with those obtained by liquid spraying.

Applications of arsenate of calcium for case bearers and budworms on large orchards of big trees can probably be made more satisfactorily and expeditiously by aeroplane than with sprayers. The catalpa trees dusted were about 30 feet tall and planted 8x8 feet.

A more detailed description of the spraying of this grove of catalpa trees is contained in an illustrated article on this subject in the March, 1922, issue of the National Geographic Magazine. Messrs. C. R. Nellie and J. S. Houser, the authors of this article, state that early in the spring of 1921 they began seeking an opportunity to conduct a practical test of the aeroplane as a distributor of insecticides. In a few instances the plan was received with favor; in others it was considered a theoretical, impracticable and foolish undertaking, and from many sources much good-natured chaffing was endured. Finally, however, a cooperative project was arranged with the officials of the Aviation Experimental Station at McCook Field, Dayton, Ohio, who entered into the spirit of the undertaking in a whole-hearted manner, giving it priority over everything in the field for one entire day. Those chiefly concerned were Major T. H. Bane, Chief of the Engineering Division; Major H. S. Martin, Chief Engineer, and his assistant, Mr. E. Darmoy, who designed the hopper to carry and distribute the poison and who operated the mechanism during the flights; Lieut. J. A. Macready, Acting Chief of the Flying Section, who piloted the plane, and Captain A. W. Stephens, photographer, who made a remarkable series of photographs of the dusting plane in action. Three of these photographs accompany the

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article in the National Geographic Magazine.

The plane used was a Curtiss JN6, which flew at a speed of 80 miles an hour at an altitude of from 20 to 35 feet and in a line 53 yards to the windward and parallel to the grove. The dense cloud of poison dust thrown out behind the moving plane was grasped by the wind and floated through and over the grove, covering the foliage in its passage. Not a tree could be found, and many were climbed and examined, whose leaves did not bear particles of the deadly poison, easily detected by the unaided eye.

The outstanding feature of the application was the remarkable precision with which the poison could be placed at the point intended, thus dispelling the idea expressed by many before the test was made that the poison dust would be tossed willy-nilly by the air currents—wholly beyond control.

On the morning following the application of the dust some of the caterpillars were dead and many were ailing. Forty-six hours after the fog of dust had polluted their food, the evidences of the wholesale destruction of the insects were everywhere apparent. Hanging on the branches and remnants of foliage, on fence posts and weeds; lying on the forest floor and secreted beneath its refuge were literally millions of the insects. Not a step could be taken without crushing numbers of them, some of which already had begun to putrefy. Large sheets had been spread beneath the trees to record the dead caterpillars as they fell, but here again the photographic record is inadequate, for the dying insects had a tendency to crawl off the sheet to die in seclusion. Nevertheless, on five square feet of one

(Continued on page 71)

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to get acquainted with more of our prices appearing in these columns from time to time. We are getting out a catalog which we want to place in the hands of every one who desires to keep in touch with the latest prices in AIRPLANES, MOTORS, SPARE PARTS and ACCESSORIES. Let us have your name for our mailing list.

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(Continued from page 67)

of the sheets 100 dead insects were counted.

The authors state that the effect on the insects had far exceeded their fondest expectations. They had confidently believed that the smaller caterpillars would be killed, but had scarcely dared to hope that it would be possible to kill the large arvae, since it is a well known fact that the full-grown caterpillars are difficult to poison. A careful investigation revealed the astonishing fact that not over one percent of the caterpillars remained alive on the trees, and the minute observations and notes by the experts who witnessed the test preclude the idea that the destruction of the insects could be attributed to any other agency than the poison.

In conclusion the authors state that when one considers the success which attended the test, conducted as it was with rude apparatus and without the aid of guiding experience in the manipulation of the machine, it seems certain that the aeroplane will be used successfully in the future to control forest insects. Whether it will be possible to employ this method for the treatment of cotton or other low growing crops, or even in large fruit orchards which permit the economical use of terrestrial machines, remains to be seen. In the treatment of tall trees in park and forest areas the tremendous saving in time and labor in which its use results would seem to indicate that the method is wholly practicable.

Valuable Co-operation

Ralph M. Foster, of Homewood, Pa., and his twenty-nine associates, who signed the following letter to Congressman Licks, deserve congratulations for their

practical interest in aeronautics:

The undersigned wish to present, for your consideration, the following comments and criticism on the Bill to create a Bureau of Civil Aeronautics, firmly believing that you will give the same your closest attention and hearty support:

Section 4—(a) Could not the Bill be more explicit in regard to the condition, capacity, and safety of aircraft, necessary to pass said inspection?

Section 4—(b) It is very easy to greatly hamper (and unnecessarily so) aeronautics by too many and wrong traffic rules, in the light of our experience with such traffic. Let us make as few, sensible, and broad-minded ones as possible, and add thereto as experience in the United States, not foreign countries, shall dictate. Should not such rules and regulations be incorporated in said Bill (as far, and as much in detail as our present experience will permit) so that all will be assured of just treatment under said Bill?

Section 5—(a) Could not the Bill be more explicit as to the requirements and qualifications of "pilots and other such persons", and in regard to the "good cause" for suspension or revocation of licenses?

Section 5—(b) Also in regard to the registration, identification, and certification of both aircraft under (b) and fields under (c)?

Section 7—Should not those engaged in civil aeronautics and commerce also be consulted, as well as "other established governmental agencies", before such rules and regulations are formulated that are not incorporated in said Bill when it becomes a law? Should either the Secretary of Commerce or the Commissioner of Aeronautics have the power to formulate rules and regulations so vital to the

country at large, so liable to hamper and retard the growth of civil aeronautics, and work injustice to those engaged therein? This should also apply to Section 8 and Section 19.

Section 14—Should also make clear that the fees and charges should *not exceed* the cost thereof and should be kept as low as possible, as the cost of civil aeronautics is already heavy enough.

Section 21—That this Bill shall take effect in three months instead of immediately.

Peoria Landing Fields

The following information concerning landing fields for aeroplanes and seaplanes at Peoria, Ill., has been received from C. C. Meydam, U. S. N. R. F.:

(a) A new landing field, containing about 45 acres, belonging to the Peoria Aircraft Club, has been constructed about 5 miles north of the center of the city, between two railroads, and bordered on the west by a hard concrete road. The field is square, marked with a circle divided into quadrants by two perpendicular lines, and has at the southeastern corner a hangar large enough to house five planes; telephone in hangar. Gas and oil can be secured on short notice. The number of the phone to secure service will be posted in the hangar.

Approximate position: Latitude 40° 45' N., longitude 89° 36' W.

(b) The field available for landing at the Peoria driving park is small and rough and should be used only as an emergency field.

(c) A good landing for seaplanes can be found in the Illinois River behind the Government breakwater, near the baseball park and northward of the ice houses. Service can be secured.



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WEEKLY

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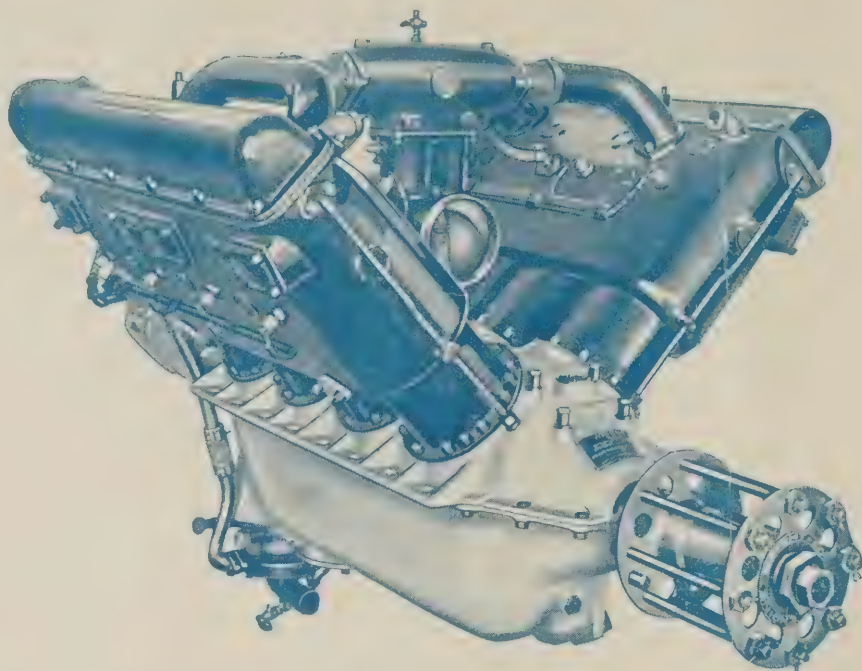
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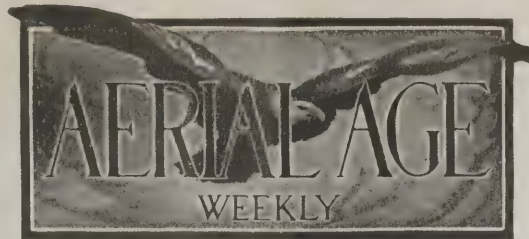
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Vol. XV, No. 4

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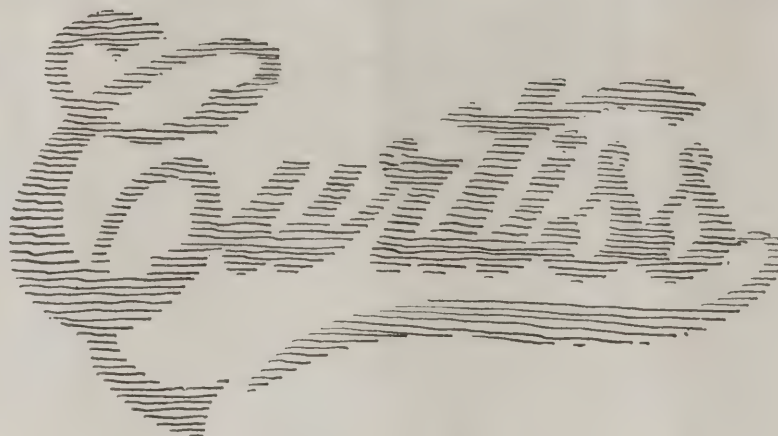
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VOL. XV

NEW YORK, APRIL 3, 1922

No. 4

Advancing Night Flying

IF there is any one item which, more than any other, affects the utility and safety of aircraft it is the capacity to fly in the dark and in fog. Over very long routes, such as for instance England to Australia, the capability to fly at night as well as in the daytime is practically equivalent to doubling the speed of an aeroplane. It is not, of course, quite so, as there must be delays in transferring passengers and/or mails from one machine to another, but for practical purposes the speed is very nearly doubled. To do so by any other means would be out of the question. Or, looking at the matter from another point of view, to be able to fly at night is the means of drawing full advantage of the speed of the aeroplane, when otherwise this could not be done. On the long routes it is of little use to be able to do 100 m.p.h. for 12 hours, and then having to stop for another 12 hours. The practical speed is then only 50 m.p.h. But by flying at night an average speed of, say, 70 or 80 m.p.h. could be maintained, which would be so vastly ahead of any other means of locomotion as to give aircraft an enormous advantage. Any means which can be taken for rendering safe flying by night and in fogs is therefore entitled to serious consideration.

In this connection, the Loth guide cable, which has recently been developed by the French, is of more than ordinary interest, and appears to promise great things for the future. Already the French Government has decided to equip le Bourget with such a cable, and there is more than a possibility that the cable will be extended from le Bourget to the French coast, as a first step towards introducing this means of guiding aircraft over the French portion of the London-Paris route.

The results of this first test should be watched very carefully by those companies in this country contemplating the establishment of air lines.

Safeguarding Air Travel

THE tragic loss at sea of the Miami flying boat bound for Bimini with five passengers on board has had a depressing effect upon the Florida coast resorts, where such excur-

sions were becoming popular. But it will not retard the progress of commercial aviation. Many cases of long-continued operation of passenger-carrying planes without fatal accidents can be cited. Between January 1, 1921, and September 17, 1921, 582,000 miles were flown on the Paris-London, London-Brussels and London-Amsterdam routes without the loss or serious injury of a passenger. Twelve types of planes were used—French, British, Dutch and German. In all 9,051 passengers patronized these lines. Mail and freight were also carried. On the London-Amsterdam service (265 miles) ninety-six journeys were completed, which was the best showing; on the Paris to London route (240 miles) 10 per cent. were not finished. All the details of landings for one cause or another are not available, but if destinations were not reached it was mainly because the service was conducted with caution, the safety of passengers coming first.

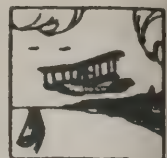
Early in the year the German Airship Company, founded after the armistice, published a report showing that in three years of operation "the number of aviation accidents, in proportion to the number of miles covered, was no greater than the number of railroad accidents."

In the United States confidence in the security of aeroplane transportation will grow slowly until construction of the machines, inspection of them, and the training and licensing of pilots are so well regulated by Federal law that there will be no more "joy-riding," and companies operating services can be held responsible for damages. The Miami-Bimini disaster carried its lesson. "Loss of this plane off the Florida coast," said Rear Admiral WILLIAM A. MOFFETT, Director of the Naval Air Service, "is an additional proof of the urgent need of the passage of the bill now before Congress creating a Bureau of Aeronautics in the Department of Commerce for the regulation of commercial aviation." Admiral MOFFETT declared that "all aeroplanes carrying passengers should be required by law to be equipped with radio." If the flying boat which was wrecked in the sea almost within sight of Bimini had had a signaling apparatus, every one on board would probably have been saved. A call for assistance would have been picked up ashore as well as by vessels plying up and down the coast.

—Editorial in New York Times.



THE NEWS OF THE WEEK



Vincent Astor Orders Air Yacht

The monoplane air yacht which Vincent Astor has bought for sport and utility is being built in the plant of the Loening Aeronautical Engineering Corporation and will be delivered in June.

The cost of the machine is not given, but there will be no economy in fitting the yacht-like cockpit. To be certain that the coiffures or yachting caps of any of his guests are not disturbed—the Loening flying boat carries five passengers—Mr. Astor has specified that an unusually high windshield is to be provided. The seating arrangements will be similar to that in a sedan motor car.

With its 400 horsepower Liberty engine, Mr. Astor will be able to fly at a speed of 135 miles an hour, with 120 miles an hour as the craft's comfortable gait. The Loening flying boat has demonstrated its ability as a climber, but the great sport of air yachting, according to Grover Cleveland Loening, the designer, lies in racing over the water at a height of 40 feet.

Mr. Astor placed his order after several flights between Palm Beach and Miami with David H. McCulloch, pilot of the NC-3 in the transatlantic flight, now with the Loening Corporation. Ross K. Judson, Vice President of the Continental Motor Corporation, Detroit, has also ordered a Loening monoplane air yacht, to be equipped with a 400-horsepower Curtiss engine, and the Wright Aeronautical Corporation, Paterson, N. J., has ordered one for the use of its officers, this craft to be equipped with a 300-horsepower Wright engine.

A New Gas for Airships

Currenium is the name given to a new gas for airships demonstrated this month at Los Angeles. It possesses a lift about equal to hydrogen, and has non-inflammable and non-explosive qualities which promise to revolutionize the airship industry. Currenium is a manufactured gas and can be produced in any quantity by an electrolytic process at a cost, it is estimated, about \$100 per thousand cubic feet less than it is costing the Government to produce helium.

The new gas has been developed by Dr. Edward Curran, head of the research department of the International Transportation & Manufacturing Company, of Los Angeles, which controls the formula and all rights in the product. It is the result of several years of research work by Dr. Curran, who is a chemist, and who produced the gas successfully in 1918. He was not satisfied with the certainty of purity under production and so continued his development of the process for three years. As a result the company owning the formula is preparing to engage in the manufacture of the gas.

Currenium weighs 6.2 pounds to the thousand cubic feet at a barometric pressure of 30 inches and a temperature of 40° F. Its lift under these conditions is therefore 73.8 pounds. In a demonstration made by Dr. Curran at Los Angeles March 13, a flame was passed through the gas and an electric spark inserted in it without setting it off or occasioning fire or explosion. The purity was allowed to drop below 80 per cent without affecting the flame or fire test. Currenium was put into a small balloon, demonstrating excellent buoyancy.

The test was witnessed by W. G. Scott,

President of the Aero Club of Southern California, and other members of the Aero Club and the Commercial Aircraft Association of Southern California.

A small elongated balloon filled with Currenium was allowed to drop in purity and a flame was applied to the end of the balloon. The gas did not explode and the balloon was only burned where it was brought into touch with the flame, the Currenium escaping through the hole thus made. Under certain conditions of extremely low purity which give practically no lift, and which would never be allowed to exist in aircraft, it was found possible to unite Currenium with oxygen and air and cause a flame, but without explosion.

The International Transportation & Manufacturing Company, the owners of Currenium, is a \$2,500,000 corporation with headquarters at Los Angeles. It has taken over the Hall Aeroplane Company and the helicoidal propellers and vertical lift appliances invented by Charles S. Hall, and has developed a combination type of aircraft known as the "Airway Load Carriers." Mr. Hall and G. B. Hannaman are the executives of the corporation and a number of well-known aircraft men are on its staff. The Company plans to engage in the manufacture and operation of load-carrying aircraft.

Scouting for Seals by Airplane

St. John's, N. F.—When the Newfoundland sealing fleet ran into a herd of seals the hunters congratulated themselves upon being able to begin the kill so early in the season. But pilots of two aeroplanes which had been scouting for the fleet informed them that they had killed almost all the seals in that vicinity and that they were in a position remote from the main herd.

The aeroplanes made a 200 mile flight eastward and located the main herd. Then they flew back to the fleet, descended and delivered their message and carried away some baby seals as souvenirs.

Kansas City Establishes Airport

Kansas City now has an established airport. The American Legion Flying field at 67th street and Belinder road was leased on February 23, 1922, by the Flying Club, of Kansas City. Major Howard F. Wehrle, president of the organization, signed the lease.

The selection of the field followed a meeting of the club at the Hotel Baltimore on February 20th, at which time arguments were introduced regarding the advisability of taking a field at this time. It was pointed out by the majority of the members that the field was necessary if Kansas City was to progress with aviation.

With the announcement of the selected field, Archibald Johnston, representative of the Huff-Daland Company of Ogdensburg, N. J., established a branch agency for that company in the Missouri city. Also a flying school is now being established by H. H. Steely, for the purpose of training aviation pilots.

The Laird Aircraft Company of Wichita, Kansas, is also opening a branch office in Kansas City. This company will operate a regular passenger service between Kansas City and Wichita. H. Bagby a member of a Kansas City bank, has built a thirty passenger plane which he expects to put into passenger service be-

tween Kansas City and Chicago.

There are now four ships on the field awaiting hangar space. Two temporary structures will be erected this week. In addition a telephone service, a booth and office has been installed at the field. A field manager has been hired and is now clearing the path for incoming ships. Within the next two months, the flying club expects to have two steel hangars on the field with full equipment in the line of gas and oil filling stations.

The flying club has now a permanent footing and will continue its active operations. For a time after the recent American Legion Flying meet, the organization temporarily dropped activities until one day in January the body met and discussed the financial standing. Then came the meeting in February. New officers were elected and the by-laws were revised to meet the demands for membership qualifications. Mr. Wehrle was chosen president, Fred Mann, vice president, and Stanley Wengert, secretary and treasurer.

With the operation of all the ships which are now being placed on the field, Kansas City expects to forge ahead in aviation and make up for the lost time it encountered with the lull in flying activities following the Legion meet.

Hampton Roads Light

About February 7, 1922, a *flashing white light every 4 seconds, flash 0.8 second, eclipse 3.2 seconds*, of 4,000 candlepower will be established, 65 feet above the water, on the corner of Hangar No. 1, Naval Air Station, Naval Operating Base, Hampton Roads.

The light is located 1,400 yards 94° 30' from the clock tower.

Approximate position: 36° 57' N, 76° 18' W.

COMING AERONAUTICAL EVENTS

AMERICAN

- Apr. 30.—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.
- May —National Balloon Race.
- Sept. 4.—Detroit Aerial Water (about) Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
- Sept. 15.—Detroit Aerial Derby, (about) Detroit. (Pulitzer Trophy Race.)
- Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

- Aug. 1.—Coupe Jacques Schneider. (about) (Seaplane speed race.) Italy, probably Venice.
- Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.
- Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

The AIRCRAFT TRADE REVIEW

Southern Aero Service

The Southern Aero Service has been organized at Daytona Beach, Florida, and will shortly open an aviation school, using JNs, Avros and a Sopwith. A. L. Macnair is general manager of the company and associated with him are Bill Lindley, Capt. J. A. Yonge, E. Ekstrom and Eric Bass.

The company expects to represent manufacturers in the sale of machines, supplies and accessories, and any organizations having a proposition to present to the company are assured of their consideration.

Government and Industry Cooperate in Standardization

At the request of Hon. Herbert C. Hoover, Secretary of Commerce, the American Engineering Standards Committee has designated Mr. A. A. Stevenson, the retiring chairman of the committee, as a special representative to work with the department in the co-operation between the department's Division of Simplified Practice and the American Engineering Standards Committee.

The Division of Simplified Practice is a co-ordinating unit of the Department of Commerce assisting in those reductions of excessive variety and other simplifications which many industries are undertaking in order to decrease the cost of production and distribution of manufactured articles. The work of the division was organized in the latter part of 1921 and is now actively under way.

The American Engineering Standards Committee, which serves as a national clearing house for a broad field of engineering and industrial standardization, has offered Secretary Hoover the use of its machinery in carrying out the detailed work on technical projects initiated in the simplification program of the Department of Commerce. The committee hopes to be of great value to Mr. Hoover in this simplification program of the department. It was as a result of this hope that the designation of Mr. Stevenson as a representative came about.

Easter Airways to Start Operations

Easter Airways, Inc., a Maryland corporation with offices at 1403 Fidelity Building, Baltimore, has been organized to enter the field of commercial aerial transport on a permanent basis, the Aeronautical Chamber of Commerce of America announced March 13. The stock of the company has been entirely subscribed and the subscription books are now closed. The company numbers among its shareholders several of the most prominent business men of Baltimore who are firm believers in commercial aviation.

The officers are: P. Ewing Easter, president and general manager; Conway W. Cooke, vice-president; C. Delano Ames, secretary; John S. L. Yost, treasurer; Maloy, Brady, Howell & Yost, attorneys.

For the present the company will confine operations exclusively to seaplanes.

How Safe Is Flying?

The De Luxe Air Service, Asbury Park, N. J., in going over its 1921 history claims

the long distance flying record for Canadian Curtiss machines without accident. Last December, Verne Treat, their head pilot, flew south from Asbury Park, N. J., to Birmingham, Ala., to practice aerial performances with Ruth Law, prior to the fairs. On the way, special exhibitions were given at many towns and many passengers were taken up, often using city streets as an aerodrome, on account of muddy fields in midwinter. This round trip covered three thousand miles cross country flying, without mishap.

Returning in January, Treat reported the need of more power, greater stability, greater factor of safety, faster climbing and slower landing speed.

Mr. H. A. Slewter, treasurer of the company and former A. E. F. pilot himself, conceived the idea of using upper Canuck wings on the plane, instead of lowers, larger tail group, three rows of struts to a wing and OXX motors as well as internally bracing the fuselage. Two ships were so equipped and performance was beyond expectation.

Thus equipped Treat left for Detroit in May to join Ruth Law on a barn-storming exhibition in the Middle West. This lasted two months, during which time close to fifteen hundred cross country miles were covered. The big fairs started in August, and it was decided to send the second ship to act as a guarantee of performance to Treat. Jack Casey, of the De Luxe, took this ship through to Sedalia, Mo., in three days, and arrived just in time as Treat was having motor trouble, due to poor oil used at a supply station. Then they flew to the Minnesota State Fair, thence to Omaha, Battle Creek, and finally Trenton, the two ships flying over 6,000 cross country miles, carrying passengers and doing dare devil stunting.

Without mishap, the ships flew over 10,000 miles, over 300 hours in the air, and never broke anything but two propellers in muddy fields.

This flying included dozens of auto-plane changes, wing walking exhibitions and night flying with fire works.

The De Luxe Company claim that this record was chiefly made possible by two factors, superior new equipment and expert pilots. They claim an aeroplane is as safe as its pilot.

In two years the company has carried over one thousand passengers, and with the exception of two slight forced landings, have never had an accident with a passenger. None of the latter have ever suffered a scratch.

This years program includes passenger carrying and sale of parts, of which the corporation has a large amount. Their prompt shipments, fair prices and good merchandise have made them many friends.

They are one of the few companies who have operated in as many different lines, so successfully.

Emergency Landings Only

The following cities and towns report that landing facilities are no longer available as of February 1, 1922: These fields must hereafter be considered as avail-

able for emergency landings only:

Hot Sprinks, Ark. Decatur, Mich.
Forest City, Ark. Deli Mills, Mich.

Hemet, Calif. Flint, Mich.
Marysville, Calif. Fowler, Mich.
Porterville, Calif. Milan, Mich.
San Bernardino, Cal. Niles, Mich.

Middletown, Conn. Mayer, Minn.
Pine Creek, Minn.
Red Wing, Minn.
Wabasha, Minn.

Avena, Ill. Ironton, Mo.
Belleville, Ill. New Haven, Mo.
Carrollton, Ill. St. Genevieve, Mo.
Chatsworth, Ill. Wentzville, Mo.
Delavan, Ill.

Galesburg, Ill. Drummond, Mont.
Joilet, Ill. Livingston, Mont.
Mattoon, Ill.
Ottawa, Ill.
Pierron, Ill.
Urbana, Ill. Syracuse, N. Y.

Fowler, Ind. Goldsboro, N. C.
New Richmond, Ind. Raleigh, N. C.

Bonaparte, Iowa Huntington, Tenn.

Abilene, Kans. Hicks, Tex.

McPherson, Kans. Petersburg, Va.
Lewiston, Me. Suffolk, Va.

Battle Creek, Mich. De Soto, Wis.
Cairo, Mich. Oconomowoc, Wis.

Performance of Maybach 300-Horsepower Aeroplane Engine

This report by S. W. Sparrow, deals with the results of a test made upon a Maybach engine in the altitude chamber of the Bureau of Standards, where controlled conditions of temperature and pressure can be made to simulate those of the desired altitude.

The results of this test lead to the following conclusions: From the standpoint of thermal efficiency the full-load performance of the engine is excellent at densities corresponding to altitudes up to and including 15,000 feet. The brake mean effective pressure is rather low even at wide-open throttle. This tends to give a high weight per horsepower, inasmuch as the weight of many engine parts is governed by the size rather than the power of the engine. At part load the thermal efficiency of the engine is low. Judged on a basis of performance the engine's chief claim to interest would appear to lie in the carburetor design, which is largely responsible for the excellent full-load efficiency and for its poor part load efficiency.

A copy of Report No. 134 may be obtained upon request from the National Advisory Committee for Aeronautics.

Reserve Squadron Quatered at Crissy Field

The 316th Reserve Squadron is now very jubilant over the fact that they have at last taken over the new quarters at Crissy Field. Members of this squadron are planning on a formal acceptance in the near future, which event will be coupled with appropriate ceremonies.

THE PROGRESS OF RESEARCH

By Brig. Gen. R. K. BAGNALL-WILD, C. M. G., C. B. E., F. R. A. E. S.

Director of Research in the British Air Ministry

RESEARCH work for the Air Service comprises specific researches at establishments under the control of the Air Ministry, and in addition an important series of studies carried out at the Universities by arrangement with the Ministry. There is, furthermore, much other research work carried out in the Universities, quite independently of the Government, the results of which are of great importance to the future of flying. It is at least as important for the Director of Research to be in touch with cognate researches in the Universities and other research organizations, at home and abroad, as it is for him to be cognizant of the developments aided by State finance through the Air Ministry. The chief research establishments under his direct control are the Royal Aircraft Establishment at Farnborough, the National Physical Laboratory and the Air Ministry Laboratory. The practical applications of the results of research are tried out at the air stations at Martlesham Heath, the Isle of Grain, Biggin Hill and, by the courtesy of the R. A. F. Coastal and Inland Areas, at certain other air stations.

The Directorate of Research is, however, an engineering as well as a scientific organization. It acts as the engineering department of the Ministry and probably as much as four-fifths of its work relates to experimentation with specific appliances, efforts to develop such appliances along channels useful to aeronautics, and the test performances of approved air service material. The balance is research, pure and applied. To preserve the right relationship between these two divisions, and to see that the right men are employed for them, is perhaps the most important of the duties allotted to the Director. There is always a tendency for experimentation which promises quick results, whether positive or negative, to squeeze out the more lengthy investigations, even when the latter are of the more fundamental importance. A firm attitude and a long view are the right correctives.

Long experience has taught the Universities the most suitable organization by which research as distinct from ordinary technical work can be undertaken. This is found to require for its success a much larger amount of personal freedom of work than had previously been the rule in Government organizations. It is naturally somewhat difficult to adapt the new Government machinery to this new condition. The subject was discussed with much ability in the last Wilbur Wright lecture before the Royal Aeronautical Society. The lecturer, Major G. I. Taylor, F.R.S., pointed out the great difficulty of organizing scientific research on the man-hour principle, adding that "in my opinion research work is so difficult and exacting that a man can only turn out his best work if he is completely free to go where his researches lead him, free to choose his own time for work, free from other duties which would divide his mind, and lastly, free to sit down and produce no visible result for weeks on end." In certain forms of applied research the problem is little different, and this is one side of the work with which the Directorate of Research has to deal. The other, larger, but fortunately simpler, mass of work consists in the design, development and ultimately the production of apparatus or methods which the work of the research organization shows to be capable of serving some definite Air purpose. In theory it may be possible to draw a sharp dividing line between these two classes of work, but in practice they tend to shade off into each other in a bewildering way, and such boundary as there is is liable to vary its position in accordance with the subject under investigation. Moreover, with limited funds it is sometimes necessary for the research worker, who may have initiated a new development, to see it through its infant difficulties, and mother it until it is in suitable form for the production stage.

It may, I think, fairly be stated that the biggest technical problem affecting Civil Aviation is the development and perfecting of the aero engine: the nature of the ground organization, the question of flying over or under clouds, the attractiveness of air travel to possible passengers, these and numerous other such questions turn on the fundamental issue of engine performance.

For Service aviation an important feature is perhaps its relationship to sea power. This problem has been notably advanced by the recent tests carried out by the United States Government, the results of which have been the subject of anxious and careful study here. If, as appears from these tests to be possible, the defence of these shores can be en-

trusted to aircraft, an immense impetus will be given to aviation and to the scientific studies on which its development depends.

Aero Engine Research

The ultimate aim of aero engine research is to produce an engine as free from breakdown as the average engine in a motor vehicle. It sometimes seems to be regarded as a matter for surprise that, with the many years of experience of the high speed petrol engine for motor cars, it has not yet been possible to develop a high speed petrol engine of equal reliability for aircraft. It must be recollected, however, that the engine in a motor vehicle runs on the average at about one-third of its full brake horsepower, whereas, until quite lately it was customary for aero engines to be run at from 80 to 100 per cent. of their full load; it is only now, with the Napier "Lion" engine, that on the Cross-Channel Service it is possible to run on an average load of but 60 per cent. of the maximum. This in my view is the fundamental difficulty. It is of course much increased by the need for cutting down the weight per horsepower to a minimum.

Whether, in addition to the attainment of some development that will cause the aero engine to be as free from sporadic "breakdown" as is the engine on a motor vehicle, it will be found possible to increase materially the fuel economy of such engines and so to cut down the gross load, and therefore the horse-power required remains to be seen. It may, however, I think be said at once that it is very unlikely that the internal combustion turbine will, for many years, if ever, prove a satisfactory prime mover for air work; the difficulty of obtaining material to stand the high temperatures involved coupled with the low efficiencies even theoretically obtainable does not make this an attractive proposition. Probably the steam turbine would be a better prime mover than the internal combustion turbine, but even here I think it quite doubtful whether it will in the end show any advance on a reciprocating engine working on the internal combustion principle.

Many pin their faith to the almost magic properties of specific fuel mixtures, but the work of Tizard and Pye and that of the Ricardo Laboratory have shown that the efficiency and horse-power obtained from any mixture of the various volatile hydrocarbon fuels are, within two or three per cent. the same as from any other, provided that the compression ratio is not altered. Any advantage to be gained from a specific fuel mixture must lie in its relative freedom from detonation, and therefore in its suitability for employment at a higher compression ratio, with the resulting higher fuel economy. Aero engines at present are operated on the four-stroke cycle; to adopt a two-stroke cycle might at first seem advantageous when larger horse-power for small weight is desired, but unfortunately such engines are less economical in fuel, and the extra weight which has therefore to be carried in the fuel tanks is very likely to mask the gain in weight from change of cycle.

Experiments are in hand to determine whether it is better to replace the carburetor system by some method of direct injection. Dr. Ferranti is attempting this on a Tuxham two-stroke engine. At the Royal Aircraft Establishment tests are being made, with Professor Hawkes' assistance, to employ shale oil and operate on the Diesel cycle. For this purpose a single cylinder engine from an ordinary Otto cycle aero engine is being used, and it is hoped to run up to an engine speed of 1000 r.p.m. The freedom from fire risk afforded by such a fuel would be a substantial gain; economy in running cost should also result. At the Royal Aircraft Establishment work is also proceeding on the solid injection of a fuel consisting of 95 per cent of alcohol.

The advantages which it is considered should accrue from the use of direct injection are these:

- (1) High flash point fuel could be used, thereby reducing fire hazard.
- (2) Cheaper fuel.
- (3) Higher compression ratios and therefore better fuel economy.
- (4) Fuel supply to engine more positive than when it depends on small heads, and is liable to be upset by small particles of dirt.
- (5) The elimination of the ignition system would remove a source of unreliability and trouble.
- (6) As air only is compressed, the way is opened up to an economical two-stroke engine with its advantage of

more even torque for a given number of cylinders, and (probably) less weight per b.h.p. By using a suitable air compressor of greater capacity than that necessary for normal 2-cycle working a super-charging engine would be obtained as a straightforward development.

One peculiarity which distinguishes aero engines from motor engines is that they have to be ready to operate at very low atmospheric pressures. The pressure of the atmosphere at 20,000 feet altitude is only about half its sea level value, so that for an engine working on the most efficient mixture ratio, only half the weight of fuel and air would be drawn in on the suction stroke, and the horse power would fall accordingly. Very successful efforts have been made to introduce an air compressor turbine, driven by the engine exhaust, in order to compress the inlet air to approximate equality with sea level pressure. When this is done effectively the full horse power is obtained at altitude. Using this device the American Army Aviation Authorities have shown that it is possible to achieve an altitude of some 40,000 feet. Experiments on these lines are also in course of being carried out at the Royal Aircraft Establishment at Farnborough.

In order to facilitate tests under high altitude conditions and save having always to fly the engines at such altitudes for this purpose, it is necessary to provide a special test house in which the whole engine with its intake and exhaust can be kept at an air pressure, and temperature, corresponding to that at the desired altitude. In the altitude test house at Farnborough the air inside a chamber about 10' x 10' x 12' is thus created. Care has to be taken to ensure that the air thus cooled does not deposit ice or snow in the engine; for this reason the air is cooled some 20 or 30 degrees below the point at which it is desired to use it, centrifuged to remove ice particles, and then allowed to rise in temperature and thus become "dry".

To carry out a scientific engine test during flight requires not only a measurement of fuel consumption, but demands also that the weight of the air used should be measured. This is no easy matter, but its achievement has been much aided by a suggestion made by Professor Callendar, F.R.S., to reverse the laboratory method employed by him for the measurement of the specific heat of gases. For air work the specific heats are known, and so the weight per second of the air flow can be ascertained. This is now under trial at altitude at Farnborough. The use of this apparatus and of the new R.A.F. Thrustmeter should enable far more complete air tests to be carried out than have hitherto been possible.

The experimental flight carried out by my predecessor, Air Commodore Brooke-Popham, from Egypt to Mesopotamia and back, brought out with much emphasis the need for economising water on such flights. If water could be dispensed with entirely in favour of air cooling a great step forward would be made. Moreover from a fighting point of view it would be of great advantage since it would make the engine very much less vulnerable to hostile machine gun fire. The staff at Farnborough have long been of the opinion that this was a possible development, and we now have the Bristol Company's "Jupiter" engine of 380 H.P., a nine-cylinder radial engine of which much is expected. There is also the Siddeley "Jaguar" of 350 H.P.; whilst in some other tests a single cylinder, air cooled, has given as much as 222 b.h.p., with a brake mean pressure of as much as 134 lbs. per square inch. There are enthusiasts who consider that an air cooled engine of 1000 H.P. should not be impossible of attainment; and that with one or other form of cooling an aero engine of 2400 H.P. at 750 r.p.m. should be possible. An advantage of big engines is that the lower r.p.m. avoids the use of reduction gearing of the propeller (and so reduces weight by some half pound or b.h.p.)

A point which is sometimes overlooked when considering the relative merits of the concentration of power in a large single engine, and its division between two or more smaller engines, is the additional weight per horse-power necessitated by the greater mass of engine "accessories" in the latter case.

If from the weight of the power unit (including propellers) we deduct the weight of the engine itself and the fuel tanks (empty) the residue of "accessories" is found (from a study of a number of typical cases) to weigh about 1.3 lb. per b.h.p. for the multi-engined plant compared with 1.0 lb. per b.h.p. for a single engine. This is for water cooled engines. With air cooling the single engine accessories figure would be nearer 0.4 lb. per b.h.p.

When comparisons are made between the weights of air-cooled and water-cooled engines, it is sometimes forgotten that although in the former case the weight of radiator and water is saved, it is necessary to include, on the other side of the ledger, an item for the additional weight of the air-cooled cylinders. Thus in a comparison made recently it was found that although the gain due to the elimination of radiator, water, pipes and pump was about 0.7 lb. per b.h.p., there had to be set against this an excess in cylinders and piston weight of 0.46 lb. per b.h.p., so that the net gain was only 0.24 lb. If the fuel and oil consumption of the water cooled engine be put at 0.50 lb. per b.h.p. hour and that of the air cooled at 0.58 lb., the two become equal as regards overall weight when a 3 hours' supply of fuel and oil is included. These are figures to be borne in mind though they do not of course affect the other advantages which successful air cooling would bring in its train.

Many efforts have been made to use other liquids than water for the cooling system. The choice, however, is a very limited one, as it is imperative to have a liquid which is everywhere cheap and everywhere readily obtainable. Oil cooling is perhaps the most promising alternative, and I hope shortly to arrange for a series of tests of this nature.

There is no doubt that both from the point of view of Civil Aviation and that of the Royal Air Force a silent machine is an enormous advantage. In the case of the former the intense noise continued for hours is one of the chief disadvantages from which an air traveller suffers. The advantages in the case of the Service machines are obvious. The source of the noise is difficult to analyze, but the propeller and the engine seem to be equally blameworthy. The latter, however, is the simpler to deal with, and as a result of very numerous tests on different kinds of silencers, I am glad to be able to say that the simplest of them all is as efficient as any. This simple form consists merely in adding to the exhaust manifold a tube of about 3 inches in diameter perforated with some hundreds of holes each one-eighth of an inch in diameter; this tube runs nearly the whole length of the aeroplane, but as it contains no baffles whatever, the back pressure is but slight and only reduces the engine revolutions by about 5 r.p.m. Moreover the extra weight, as added say to a D.H.9. or a Bristol Fighter, is only 20 to 25 lb. It has been found that with this silencer in use it is possible to carry on conversation even when the engine is at full throttle. Propeller noises are much more difficult to deal with, but experiments are in hand which I hope may assist to a solution of that problem also, though I doubt the possibility of any extensive reduction of propeller noise.

I cannot leave the subject of aero engine research without expressing on behalf of the Ministry our extreme regret at the great loss which has befallen air research work through the recent death of Major Norman of the Royal Aircraft Establishment. The most striking attribute of Norman was his immense personal courage; coupled with this, in a most unusual degree, was his inventive ability and ingenuity in design. To whatever task his mind was directed some original and valuable result was sure to follow—often enough not along the expected route, and his was too bright a genius to trammel with rigid guiding lines, but of real value to the future of flying. Such men are rare, but when discovered are worth a host in themselves. One of the most anxious considerations of any Director of Research must always be to endeavor to discover genius of this kind, and to afford it, when found, the scope that is its due. A task by no means simple.

(To be concluded)

COMMERCIAL AVIATION IN LATIN AMERICA

By WENDELL PHILLIPS BIESER

FEW parts of the world can use the aeroplane to greater advantage than Latin America, as transportation facilities there are lacking in many places. Many places which could be reached in a few hours by air line will not for many years be connected by rail due to intervening mountain ranges and wilderness.

After the war and consequent upon the really amazing development of commercial flying in Europe and the United States, English, French, Italian, German and American companies sent their representatives to Latin America to push their respective interests as much as possible. The development has resulted in the sale of airplanes, the establishing of regular air routes for the transport of passengers, mail and valuable freight wherever possible, the training of civilian pilots, the

establishment and equipment of aerodromes, and the carrying of passengers on business or pleasure bent.

In Argentina alone during the year 1921 the Curtiss Aeroplane Export Corporation, an American company, flew its ships a total of 2,434 hours, for a distance of 316,725 kilometers. They carried 5,788 passengers without a single accident to either passenger or plane other than one broken landing gear and propeller. It is therefore not hard to see the reason for the constantly increasing use of the airplane all over Latin America. At present this same company has aerodromes in Argentina, Brazil, and Peru, and they are now arranging for the establishment of similar aerodromes in Chile, Colombia and Bolivia. In many instances ranch owners in Argentina are using airplanes to reach their outlying sections quickly and comfortably.

According to a report from Buenos Aires development of regular aeroplane passenger service between Buenos Aires and Montevideo has just been achieved and hereafter two round trips will be made weekly, in addition to other air voyages of special urgency. On the first trip four passengers and a quantity of correspondence were transported.

The direct air route between Key West and Cuba, also an American enterprise, is an established success.

Some time ago a Brazilian flyer, using an American machine, carrying one passenger, covered the distance between Rio de Janeiro and Buenos Aires in fifteen hours' actual flying time, a distance of over 1,000 miles, the only ordinary communication being by steamer, the trip consuming four days and nights.

Even in the lofty mountains of Bolivia the steady drone of the aeroplane motor has recently been heard. An accompanying photograph shows a plane of French manufacture in a recent flight over La Paz, 12,000 feet above sea level. This was the second machine to fly over the city, the first pilot to do so having been an American, Captain Hudson. Flying at great altitudes, as in mountainous sections, is far from easy, as the air is rarefied and offers less support to the machine than the heavier air lower down, and therefore such feats as flying across the Andes between Argentina and Chile, as has been done, are fraught with difficulties unknown to the casual observer.

Recently a member of the Grace organization missed his steamer, which happened to be a Grace liner, at Gaillao. The ship's next port was Salaverry, a day's run and 252 miles away. The traveller climbed into a plane at Lima and was in Salaverry three hours later, waiting for the Grace steamer to arrive. Mail is now regularly transported between Lima and Trujillo by air, the only other means of transportation being by steamship.

Another example of how the airplane saved a business man much time and spared him great inconvenience is best told in his own words. Charles P. Lohse of the New York office of W. R. Grace & Co., tells the story as follows:

"On a recent trip to Colombia my business in Barranquilla had taken more time than I had bargained for and my next stop at Bogota, which meant a ten days' journey, at least.

This trip is made by river steamer to La Dorada, then by train to Beltran, then by steamer to Girardot and then the final train trip to Bogota. It is more than 600 miles and it consumes between ten and thirteen days, and is frequently made under anything but pleasant conditions. The Magdalena River is shallow, the air full of insects, the heat intolerable, the steamers slow and possessed of a propensity for running aground. The trip is such a bugbear that the prospective traveler regards it with apprehension and postpones it as long as possible.

"It is now possible to make this voyage in a far more pleasant fashion and in the short time of thirty-six hours. The Sociedad Colombo-Alemana de Transportes Aereos was formed in December, 1919, for the purpose of transporting passengers, mail, gold and other valuables by airplane. The route is between Barranquilla and Girardot and Neiva, and as the planes are equipped for landing solely in the water, the route follows the course of the Magdalena River between these points.

"The ships used are Junker sea-planes, the wings being made of 'duraluminum.' I decided to go to Bogota via the air route and so on a beautiful morning our little ship took the air at 6.40, rising gracefully into the wind with he pilot and myself as the only human freight. After three hours our first stop, El Banco, was reached and we descended to take on fuel and mail, and incidentally breakfast, which I had missed that morning. After an hour's stay we continued to Puerto Berrio where we arrived at 1 o'clock to take on mail from Medellin and the interior, and also to lunch. An hour later we left, taking with us a mechanic who happened to be in Puerto Berrio, and climbing to 6,000 feet, maintained this altitude for the rest of the three hours' trip. Shortly after 4 o'clock we arrived over Girardot and descended in a graceful spiral. I stayed overnight there, leaving for Bogota via railroad the next morning and arrived at my destination that evening. The air trip to Girardot costs 250 pesos, the return trip 50 pesos less. Including all stops I made the trip in thirty-six hours, the air flight taking nine hours. Had I travelled by the usual route it would have taken from ten to thirteen days.

"The present regular service enables the mail on the incoming United Fruit steamers to go immediately to Bogota and other interior points and mail from there is carried to reach the outgoing steamers. Recently a regular air mail service was established between Barranquilla and Cartagena."

Our progressive neighbors to the south are fully awake to the commercial advantages of the airplane and it is certain that with return to normal conditions in trade the use of the plane for commercial purposes in Latin America will constantly grow.

Clayton Sedgwick Cooper, in his latest book, "Foreign Trade Markets and Methods," says:

"The great amount of scientific study . . . leads the exporter to hope for the arrival, at no far distant date, of a day when the air will contain both messages, men and merchandise passing from continent to continent, annihilating special and geographic distances and making the world of trade one."

FOREIGN SERVICE COMMITTEE OF AERO CLUB MAKES REPORT

THE following letter recently received by the Aero Club of America constitutes an interesting report of its Foreign Service Committee in France, of which Sidney V. Veit is chairman:

"The Aero Club of France has decided to hold the International Race for the Deutsch de la Meurthe Cup on Saturday, September 30, 1922, and it is to be hoped that America will have one or more entrants. Last year it was deplored that America, with all its wealth and spirit of progressiveness, was not participating in this contest.

"I had occasion to speak of it to General Pershing on his visit to France last year, when he was in Paris to place the Congressional Medal on the tomb of the unknown soldier. General Pershing was particularly interested and asked me to give him all data as soon as the rules and regulations were issued, as he would like the Army to participate. You will receive the official notice of the coming contest with the rules and regulations from the Aero Club of France direct, and would advise you to give considerable publicity to this event.

"I would only like to add that one of the reasons why the American contestants

failed in 1920 was the lack of sufficient preparation and arriving on the grounds too late, without having the necessary time and facilities for proper testing and training. It is, therefore, my duty to advise you that the American entrants should arrive at the aerodrome not later than September 1, so as to become acclimatized and study the territory. To do this, the machines should leave America not later than August 1, as it is absolutely necessary to figure one month for the ocean voyage, fulfilling the custom formalities and bringing the machines to the flying field, a considerable distance from port. If these preliminaries are properly complied with, we can almost guarantee complete success.

"In a very pleasant and extended interview with General Mitchell I again brought home the importance of having the United States Army represented in the contest on the 30th of September. General Mitchell seems to be interested in the work that our committee is doing and kindly requested that all matters of aeronautic developments in Europe be brought to the notice of the Aero Club of America, and he would see that proper publicity be given to all this information.

"Our committee attended the banquet

given in honor of Capt. Rene Fonck, of the French Aces, on the occasion of his having been raised to the rank of Commander of the French Legion of Honor. In an interview with Capt. Fonck, I learned that it was the intention of the French Government to send him to foreign countries to lecture on aviation and possibly do some flying. In all probabilities he will leave on February 25 for Morocco, and he told me that if a request should come from the United States Government or from America, through the proper diplomatic channels, the French Government would very likely send him a tour throughout the United States. I would, therefore, recommend that you bring this matter to the attention of the various aero clubs in America and form a request and transmit same through the French Ambassador in Washington to the French Government; you would probably have the visit of Capt. Fonck on such a mission. The French Government has been sending their Marshals to various countries and would only be too glad to send their Ambassador of Aeronautics to America, if the desire was so expressed by the aeronautic world of the United States.

STANDARDIZATION AND AERODYNAMICS

by Lieut. Col. ING. R. VERDUZIO, Director, Aeronautical Experimental Institute, Rome, Italy

THE article published by Wm. Knight, in the AERIAL AGE of June 20, on Standardization and Aerodynamics has given rise to a very interesting discussion on the part of European scientists interested in the progress of aerodynamics (see discussion by Prandtl, AERIAL AGE, October 3, 1921; discussion by Von Karmann, AERIAL AGE, January 21, 1922; discussion by Costanzi, AERIAL AGE, February 20, 1922; and discussion by W. Margoulis, AERIAL AGE, March 6, 1922); and I think it should be stated here the stand taken by the Italian Aeronautical Experimental Institute, about this matter.

If we consider the progress made by the heavier than air and the lighter than air machines, we see that although the cycle has not been the same for both, the characteristic phenomena of this progress have been the same for both. In both cases, we have an initial state of uncertainty during which early experiments, not very conclusive, have been followed by a better organic conception of future experiments which have laid out the needed foundation of the technique for attaining the necessary progress.

When the thermodynamics and metallurgy both concurred in giving us a lighter and more powerful power plant, aeronautics entered a new era. The stage of uncertainty ended then and from that point on the progress made in aeronautics was both rapid and important. The dirigible and the aeroplane at that time became a practical reality. We had the necessary power for propelling them, the theory of stability was sufficiently developed and we were able from that time on to design and build machines sufficiently strong and aerodynamically sound.

After this period of comparatively rapid progress, further progress has been made at a much slower pace.

The problem of improving upon the flying machine as it is at present, is somewhat a harder problem for us today than it was the realization of the flying machine itself. At the present time we find that the fuselage of an aeroplane is of such a shape as it must be possessed by a body with good aerodynamical characteristics. This is also true of the wings. The aerial motor has also reached a stage of development where we cannot expect any revolutionary change in its design. Therefore, an increase in the efficiency of the flying machine can be obtained in the future only by making a thorough study of the aerodynamical phenomena taking place in flying so as to be able to introduce such slight changes that we might be able to make in the present designs which will allow an increase in efficiency. As far as the motor is concerned we are reduced to the point of needing to improve upon the auxiliary organs more than upon the engine itself in order to increase the efficiency of the power plant. In a dirigible we might try to improve upon the design of the gas bag, of the control planes, of the cables, and other attachments of the nacelle to the envelope and also improve upon the stream line shape of the nacelle itself. In an aeroplane we might try to reduce the air resistance of struts, landing gear and wings and investigate the interrelation existing between changes made on each single part. For instance, in reducing the air resistance of a wing, we keep in mind the fact that although a thinner wing offers less air resistance than a thicker wing, due to the fact that the thinner wing needs to be braced with struts and cables, the total aerodynamic efficiency of a thinner wing with its struts and cables is less than the efficiency of a thick wing without reinforcing members. Thus we see that monoplanes with thick wings are often to be preferred to biplanes needing struts and cables in their construction. In designing fuselages we improve the aerodynamical efficiency of them by enclosing in them both pilots and passengers.

In conclusion, the aeroplane designer at the present time has not a wide field from which to pick up improvements for his design. At the latest international aeronautical exhibition which took place recently in Paris, we have seen that the general lines of aeroplanes have remained the same as they were a few years ago. No revolutionary changes in design have appeared in the last few years. We therefore arrive at the conclusion that the cycle of evolution in the design of flying machines has reached now a stage when improvements must be looked for, not any more in the conception of the flying machine itself, but rather in the details inherent to the present design.

At the latest aeronautical international congress which took place in Paris, last November, the problem of what should be done in order to further the advance of aeronautics was such a problem that everybody felt rather keenly and when the discussion was open about what is to be expected from aerodynamics as a science for contributing to the solution of the engineering problems involved in the design of aeroplanes, all the technical men agreed that the time had arrived for estab-

lishing a closer cooperation among themselves and their studies. France, Spain, Belgium and Italy, through their representatives, advised the desirability of arriving at an agreement about the standardization of the nomenclature used in the technical works.

As a representative of the Italian Aeronautical Engineering Association, as the Director of the Aeronautical Experimental Institute of Rome, and as a representative of the Aerodynamical and power plant section of the Polytechnic Institute of Turin, I brought to the attention of the second commission of the International Aeronautical Congress, that due to the initiative of Mr. Wm. Knight, while acting as Technical Assistant in Europe to the United States National Advisory Committee for Aeronautics, an exchange of views about the matter of cooperation among British, American, French, German and Italian laboratories had already been started about two years ago. One and one-half years ago, the British N.P.L. suggested a number of cooperative tests to be conducted on models in the various wind tunnels of those laboratories to which the invitations had been extended to participate in these tests. These tests being made for the purpose of determining how the results obtained in each wind tunnel would compare with results on tests on the same or equal models in other wind tunnels. The Aeronautical Experimental Institute accepted the invitation to participate in these tests but since that time we have not heard any more from our British friends and the suggestion made by them has not been realized.

Besides, however, the need of obtaining a more intimate knowledge of the comparative value of the testing equipment used by the various aerodynamical laboratories, we have very keenly felt the handicap as brought about by the lack of agreement between technical men of all countries not employing the same notations and symbols for expressing the results of their investigation in technical works.

The Department of Italian Aeronautics, in order to try to eliminate such a handicap, in a bulletin issued by the Experimental Division, suggested about one year ago, the adoption of a set of symbols and definitions, which since then has been revised and simplified and which, I suggested to the International Aeronautical Congress, could be taken as a basis for discussion in order to arrive at an agreement. In the ensuing discussion, Prof. R. Soreau made the remark that considering the fact that the various Aeronautical Laboratories represented there, were Governmental institutions, it was not possible to arrive at any definite conclusion without the official intervention of the various Governments, but he suggested that the various technical men and directors of aeronautical laboratories, taking part in this discussion, should try to exchange their views on this matter and reach some sort of an agreement, and at the end of the Congress, a resolution could be adopted inviting the under-secretary of state of French Aeronautics to take the initiative in inviting representatives of the departments of aeronautics of other countries to meet together for the purpose of agreeing on the standardization of aeronautical terms and characteristics. This suggestion as made by Prof. Soreau was heartily approved by the technical men and it was hoped by them that some such action as outlined by Prof. Soreau, would be taken before concluding the works of Congress. However, at the joint meeting of the various commissions when the conclusions of the second commission about this matter were presented and discussed upon, the resolution was adopted with a number of changes and modifications and one of the changes made was the suppression of the meeting of the technical representatives of Aeronautical laboratories, which had been recommended.

It is out of the question that the present state of affairs when all sorts of symbols, notations and graphical methods are used in technical publications, makes it very difficult for the designers of aeroplanes to make use of the experience gained by experimental works conducted in the various laboratories in Europe and the United States and which are expressed by technical men of the various countries in so different and sometimes so contradictory ways.

As we said before, progress in aeronautics at the present stage of development must be looked forward to improvements of details rather than in the change of the general conception of the design of the present flying machine. These improvements can quite noticeably increase the efficiency and the security in flight of the flying machine and this can be obtained by the united efforts of all those who are engaged in the study of aeronautical problems; therefore, every effort should be made in making available to designers and other technical men, the results of the research work conducted in aeronautical laboratories without imposing on them the strain of memorizing symbols and definitions adopted by all countries.

The initiative taken by Wm. Knight and the suggestion made by him of calling a congress of representatives of aeronautical laboratories and other scientific organizations interested in aeronautical problems, both in the United States and Europe for the purpose of agreeing on the standardization of terms, notations and graphical methods of representation which has already been endorsed by Prof. Prandtl and Prof. Karmann and others is a very timely suggestion and as far as Italian aeronautics is concerned, we shall be very glad to cooperate in the realization of such plans, which we endorse unreservedly.

THE HUMAN MACHINE IN AVIATION

By EDWARD C. SCHNEIDER*

FLYING requires the development of a new special sense, the sense of flight. This sense is not inborn; it may be developed, but cannot be created all at once. There are men of splendid physical equipment and intelligence who could never make more than passable aviators. A good aviator should feel entirely at ease in space. He should be able to recognize at once the slightest trouble with his machine in any one of the three dimensions of space. He should react to the invisible movements of the atmosphere. The capacity to feel or sense conditions in the air and to respond properly with precise muscular contractions comes only through training, but these are based on normal physiological bodily characteristics that are not possessed by all men.

In acquiring the art of flying, man must add to himself new nervous controls and muscular co-ordinations that for many are difficult to attain. In a sense the engine and controls of the aeroplane must be made a part of the aviator's own body. In order to control the workings of his machine he uses a combination of hand and foot movements that is by no means familiar to the average person. The joy-stick must be moved by the arms forward and backward and from side to side with precision, and at the same time the rudder must be moved by the legs by a to-and-fro push. In learning the movements of the controls the average person finds it difficult to direct properly the arms and legs simultaneously.

The sensations of being up in the air are in no way unpleasant. The sense of dizziness and insecurity that one feels on the top of a high building or on the edge of a mountain cañon does not exist in flying. Usually neither the rise nor the descent of the aeroplane gives the uncomfortable feeling experienced in riding in an elevator. When one happens to stand on the ground on a high and dangerous place, he sees the wide expanse around him and has a feeling of being insufficiently sustained, or that the support may give way, hence the impression of fear and dizziness. In flying the whirl of the starting and speeding motor followed by the bump-bump of the aeroplane as it moves over the ground may arouse a sense of fear, but just as soon as the wheels of the undercarriage leave the ground this sensation is supplanted by an impression of calmness and immobility. The earth appears to be receding while the aeroplane remains fixed in position; the objects of the earth grow smaller and the earth's surface becomes like a map in appearance. In full flight there is a feeling of security, and one does not realize that the conditions of existence are altering, and that the body and its organs must adapt themselves to the new and changing environment. Height dizziness is not present, because there is no downward perspective; there is nothing with which to compare one's altitude; there is only a vast expanse of earth and cloud and no sharp outline to give the feeling of height. The earth may play pranks; it drifts away in the ascent but rushes towards one in a nose dive; it tilts up first to the right and then to the left in the bankings and turnings of the aeroplane; it may even take the position of the sky during a loop and move rapidly in a circle during a spin. During such experiences the majority of the flyers do not feel discomfort and dizziness.

The new special sense of flight may be sorely tried by weather conditions. The lower strata of the air are often of variable density due to local heating and the effects of the surface configurations of the earth; the higher strata may be turbulent near the boundaries of clouds, while dense clouds and thunderstorms may be encountered at any level.

The most common weather experience of aviators in the daytime is a sensation of bumpiness. The bumps may be likened to those felt in an automobile on a rough road which make steering difficult and uncertain. However, there is a difference. The automobile driver, if watchful, may see the bump in the road and prepare to meet it; while the air bump is invisible so that the aviator cannot prepare for it. Air bumps may be moderate or sharp. There may be smooth flying until suddenly the support of the machine seems to disappear, the propeller appears to give no pull, and down goes the aeroplane. On the other hand, the ship may suddenly rise as it enters an air zone of increased density. The magnitude of the vertical movement on bumpy days may be as little as 50 feet, which is common; but it may be as much as 200 feet, and occasionally 500 feet is reported. As seen from the ground on a "bumpy" day the aeroplane tilts from side to side from the horizontal, and now and then sharp up and down movements are discernible. Bumps may give the ship a nose dive or a side slip. When such occur too near the ground an accident may happen before the aviator has time to right himself. Professor Dockery, a psy-

chologist trained in the art of flying, writes: "It is believed that the experience of the sudden plunge of a plane in an unexpected direction is something no one can appreciate except those who have had the experience. The flyer does not merely lose his balance at such a time. He has changed his position with reference to earth by several hundred feet in a few seconds. The rush of air, the abnormal pressure upon his viscera, and the loss of the direction of gravity, are capable of creating all the conditions of a violent emotion, which if not checked quickly, become worse, and the aviator may lose all consciousness. There is no doubt that in many of the cases in which an aviator has been observed to dive or 'vrille' a thousand feet or more to his death without an apparent attempt to right his machine, this condition has been responsible for his catastrophe." Most of the bumps occur on bright, hot days and are near the ground, but they may occur at any altitude up to 3,000 to 5,000 feet. The extremely bumpy conditions are within 500 to 2,500 feet of the ground. The chief dangers are not during straight-away flying but as the aviator turns, when the bumps cause excessive tipping and side slipping.

Irregular topography of the land accounts for the development of many of the bumps. The aviator expects them along roads, railroads, edges of ploughed fields, edges of forests, along ditches, the borders of swamps and shore line, and near buildings. Down currents are met over ponds, lakes, and clumps of trees. To get into a down current when in a tail spin or in diving is dangerous and is a real test of the special flying sense. In such conditions it is not possible to stop and think; the aviator's action must be second-nature, decisive, and right.

Flying either in or above the clouds or in a fog is also a severe test of the special flying sense. There is no means of keeping one's bearing, for the fog may be so dense that the aviator cannot even see the tail of his aeroplane. The compass indicates which way the ship is pointing at any moment, but as the force of the wind may cause drifting to the side, it does not show the direction in which the machine is moving except when it is travelling exactly with or against the wind. Under these conditions he is worse off than the man who is out in a severe blizzard on a winter's day. In a cloud the aviator finds that it requires all his flying ability to keep his upright position and his direction. It is almost impossible to know whether he is slightly climbing or descending. He turns to right or left without knowing it, and sometimes unconsciously even turns over and flies upside down. Without the eyes to help him he must obtain his flying information from other sense organs. By the aid of his cheeks he may feel from the air pressure or wind whether he is turning or side slipping to the right or left. The sound of his engine will inform him if he is climbing steeply, and the singing of the wind through the wires of the machine will indicate that he is descending rapidly. He obtains much useful information from the "feel of the seat," and the air pressure and wind on his forehead may tell him whether he is nosing up or down. Unquestionably, he receives further useful information from his joints and muscles, from the semicircle canals and vestibule of his ears and from the feel of the joy-stick and the warp of the rudder. But all these sensations working together do not compensate for the loss of vision, and in a fog or a cloud it is thus distressingly difficult to keep right side up and to fly straight ahead.

From the above considerations it has become evident that in order to acquire the art of flying a man must be physically and nervously well endowed by nature. It is not enough for him to be able to co-ordinate his arm and leg movements delicately in handling the controls of the machine; he must also have sense organs that will inform him correctly of his position in space. He must be possessed of good vision for lining up the ship with the horizon, and with good hearing for the detection of any mechanical defect in the running of the engine and for information as to the position of his machine. In short, he must have a complete equipment of normal sensory organs.

Curiously enough, some men receive such exaggerated sensations through one or more of the sense organs that they misinterpret their information of position and consequently get into trouble because of erroneous movements executed for balancing. Actual experiences during acrobatic evolutions are not the same for all men. Simple looping in a perfectly adapted person produces no unpleasant sensations. Spinning, better known as the tail spin, affects men in different degrees. In normal persons the sensation deepens upon the position of the eyes and head. Some aviators keep their eyes on the instrument board and do not look outside the fuselage, while others fix their eyes on some point on the ground. Both are

* Reprinted through the courtesy of the *Yale Review*.

good methods and should not normally cause dizziness. However, in a poorly adapted person various kinds of acrobatic stunts may cause dizziness, vomiting, and even fainting in the air.

An aviator may lose control of his machine and become unconscious from various causes. Altitude is perhaps the best-known cause, but others are not uncommon. One of these is associated with the ear-drum. Ordinarily the air pressure is the same on both sides of the drum membrane. This is provided for by the eustachian tube, which connects the throat with the middle ear. If this tube permits a free and immediate passage of air, the pressure in the middle ear changes with the altitude as the aviator ascends and descends. If the air cannot pass through it freely because of its small size, or because the aviator is suffering from a cold in the head, the membrane will bulge outward or inward according to whether the inside pressure is greater or less than the atmospheric pressure. In a rapid descent the failure of the eustachian tube to open may cause the drum of the ear to lunge inward sufficiently to rupture it. Even when this does not occur, the inward bulging may cause dizziness and intense pain and sometimes fainting.

Most normal persons can be made dizzy by rotatory motions provided these are violent enough, while some are unusually sensitive to rotation and other kinds of motion. The tendency to be dizzy in a swing or to become train-sick is an illustration of the latter. Most of us learn to adapt ourselves to motions of all kinds and to maintain our equilibrium in spite of the unpleasant sensations aroused. In the same manner the aviator may gradually acquire the facility to overcome the dizziness that results from acrobatic air movements. However, some men are never able to adapt themselves to such disturbances of equilibrium and therefore ought not to fly. An air bump or some other cause might accidentally throw their ships into a spin which would cause a vertigo that would ultimately lead to a crash.

When aviators were training for war it occasionally happened that one was found who got uncomfortable in all the air work until he came to the "combat" field, where he first had the experience of chasing and being chased. In attempting to keep on the trail of the enemy or in keeping the enemy off his own tail, the aviator had continually to watch his opponent. This called for a use of the eyes to which he was unaccustomed and brought on nausea and vomiting in some men who were naturally sensitive to motion. The majority of these sensitive aviators soon became accustomed to the new experience and overcame the vomiting tendency. A few, however, failed to compensate and consequently were not fitted for combat flying.

Of all the physical attributes vision is the most important to the airman. The consensus of opinion of aviators is that the eyes should be perfect to withstand successfully the strain and work to which they are subjected. During the war a pilot was compelled to be continually on the alert looking up and down, to right and left and before and behind him. The muscular movement required by this constant turning and twisting was so great as to cause in some, after a few months, an enlargement of the neck. It follows that if the neck muscles are so exercised, the six muscles that move the eye-ball must likewise work harder than usual. The ability of these six eye muscles to work in unison and to withstand strain is most important for the aviator.

However good an aviator may be in managing his aeroplane, he has not wholly acquired the art unless he can bring his ship back to the ground. It is far easier to take off than to land. At an aviation school many pupils are classified as bad landers. Some cannot get the knack of landing a machine; they flatten out too soon or too late or put the nose of the machine into the ground. Such pilots often manage to get down without injuring themselves but not without harm to the aeroplane, often breaking the undercarriage. Others are able to get down without breaking anything, but they make a bumpy landing.

The aviator who makes good landings has a high degree of accuracy in judging distance while one who lacks this skill has a relatively low degree of accuracy in this respect. The ability to judge distance varies with the degree to which the person has developed his sense of perspective. In most of us this sense is only moderately developed. It depends on the movement of the two eyes and our judgment of the amount of movement made by each. One writer states that in landing he could judge distances fairly accurately except in the last part of the glide. In the rapid approach towards the earth, he says, "the muscles of convergence did not seem to act rapidly enough when he approached nearer than 25 feet to the ground." A slight weakness in the muscles that move the eyes may interfere with the judging of distance. There is always danger of the laming of a weak eye muscle and the consequent loss of accuracy in estimating distance in descent.

Color vision is also important in that the aviator is likely to have to select quickly a place for a forced landing. "A light

field indicates stubble; a dark green field grass or wet and marshy ground; dark green stripes running across the field, water or ditches; yellow, sand; and rough brown spots, bumps."

Thus far we have been dealing with the art of flying. It is now clearly recognized that in addition to the adjustments of orientation, the flyer must make other physiological adjustments of unusual rapidity to physical changes in the environment. As he rises from the ground level to which he is adapted he enters the rarefied air of high altitudes in which the oxygen supply is diminished and from which he must somehow secure a sufficient quantity to supply his bodily needs, if he is to remain mentally and physically efficient. Furthermore, he rises from a region of comparative warmth and ascends into one of such extreme cold that the fire of life must burn more vigorously in order to maintain the normal temperature of the body. And lastly he rises from a state of comparative atmospheric calm to fly through space at a speed that causes a rush of air that reacts upon him like a gale of wind. Each of these changes of the environment necessitates protection or adjustment if efficiency is to be maintained.

The development of aviation has made a knowledge of the effects of altitude of practical importance. As an aviator ascends, he passes from the normal barometric pressure of the ground level to a pressure which diminishes according to the height attained. Thus at about 10,300 feet the atmospheric pressure is equal to two-thirds that of the sea-level; while at 18,000 feet it is approximately one-half, and at 28,000 feet only about one-third of the pressure at sea-level. The diminished atmospheric pressure has in itself no effect on the body of man. The chief effects of altitude on the mechanism of the body are due almost entirely to a diminution of the vital constituent, oxygen, which decreases in amount proportionately with the fall in barometric pressure.

The American aviator has not had as much experience with flying at high altitudes as the seasoned aviators of our Allies in the great war. Most of the training in this country has been at altitudes under 5,000 feet with, as a rule, only one altitude flight during the period of instruction; and in that immediately the maximum altitude was attained, the ship was again nosed downward. Among one hundred and fifty American pilots who were questioned on returning from service at the front in France, the vast majority had made only one high altitude flight. By these the maximum attained was 22,444 feet, while an average maximum of 19,465 feet was recorded.

One hundred of the pilots referred to were questioned regarding discomforts noticed at high altitudes. Many of these had not been conscious of any effects. The necessity of attending to technical and other duties of a flight may suffice to divert the aviators' notice from physical symptoms unless they become very unpleasant; and, further, it is well known that one of the most striking effects of want of oxygen is a dulling of the intellect and an unwarranted feeling of well-being and security. About sixty-four per cent of our group reported shortness of breath, headache, physical exhaustion, or mental depression. They observed that the effects were transient, lasting at most for a few hours and disappearing in all cases after a period of rest or sleep.

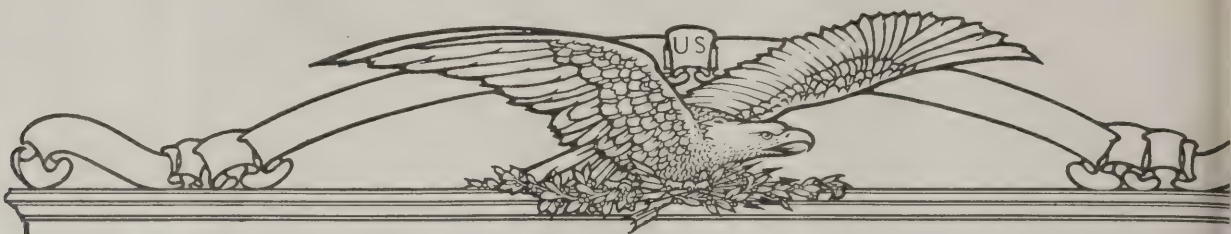
The effects of altitude as experienced by a flyer are, as a rule, quite unlike those experienced by the mountaineer. The ascent of a mountain whether made on foot or burro, in railway car or automobile, is slow in comparison with the ascent by aeroplane. The mountaineer, provided he goes high enough, will after a delay of several hours feel ill with "mountain sickness," but the aviator does not remain at a high altitude long enough to develop such symptoms as are ordinarily associated with illness. The effects of altitude as experienced by the aviator are chiefly due to a lack of an adequate supply of oxygen in the brain.

Observations on a large number of men show that all do not withstand the lack of oxygen equally well. Hence an elevation of 10,000 feet might provoke symptoms, or changes, that may be noticeable in a few men; others may escape them up to 16,000 or 17,000 feet; while only a few, possessed of unusual resisting power, can remain wholly efficient at altitudes of 19,000 to 20,000 feet. Apparently no two men are affected in exactly the same manner.

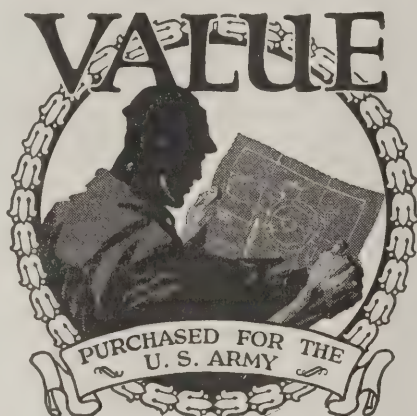
Shortness of breath is most frequently observed. Very few aviators breathe through the nose when above 12,000 feet. The breathlessness is increased by muscular exertion; merely turning the body to look around the horizon may aggravate it enormously at an altitude of 15,000 feet and more. Cold also brings it on in a more noticeable degree.

Muscular weakness has often been reported by men who have manipulated the camera of the gun at altitudes above 15,000 feet. The effort of standing has not only made them breathless but also weak; while at extremely high altitudes muscular paralysis may be experienced. In a balloon flight made in 1862 by two meteorologists, Glaisher and his assistant Coxwell, muscular paralysis was experienced by both. Glaisher first noticed at an altitude of about 26,000 feet, that

(Continued on page 86)



The War Department's for April



As an aid to the careful buyer in more closely gauging the **VALUE** offered in War Department surplus stores, the Director of Sales announces the following program for April and May.

These are only the more important sales. The government reserves the right to make such changes as may be necessary.

Several buyers in a community often find it advantageous to share the expense of sending a common representative to these sales. By this method, goods can be purchased at a figure most favorable to resale at a profit.

FUTURE SALES IN PROJECT INCLUDE:

AIR SERVICE MATERIAL: Curtiss Elmwood Depot, Buffalo, N. Y.; Long Island Engine Plant; Americus, Ga.; Richmond, Va.; Morrison, Va.; Montgomery Repair Plant, Ga.; Chapman Field, Fla.; Carlstrom Field, Fla.; Dorr, Ga.; Park Field, Tenn.; Selfridge Field, Mich.; Fairfield, Ohio; Love Field, Texas; Houston, Texas.

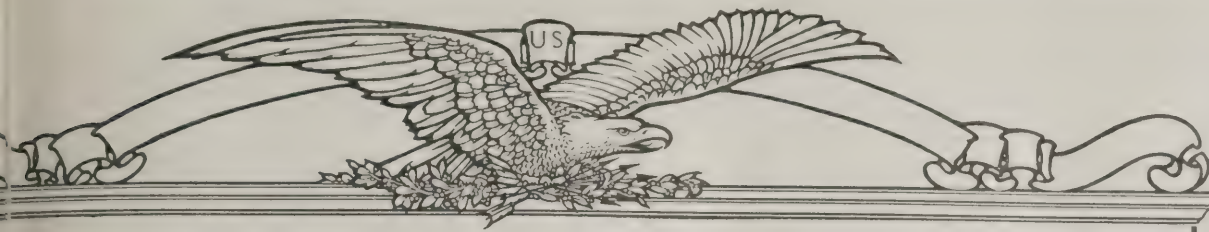
ORDNANCE MATERIAL: Amatol Ordnance Reserve Depot, N. J.; Amatol Village, N. J.; Erie Howitzer Plant, Erie, Pa.; Picattinnay Arsenal, N. J.; Aberdeen Proving Ground, Maryland.

QUARTERMASTER SUPPLIES: San Antonio, Texas; El Paso, Texas; Camp Grant, Ill.; Camp McClellan, Ala.; Camp Jackson, South Carolina; Boston, Mass.

For full information regarding all War Department Surplus Property Sales, write

MAJOR J. L. FRINK,
Chief, Sales Promotion Section, Office Director of Sales,
2515 Munitions Building,
Washington, D. C.

WAR DEPT



Selling Program and May

Place	Sales Method	Material Offered	Send for Catalogue to
10 Washington, D.C.	Sealed Bid	Shoes	Sales Promotion Section, 2515 Munitions Bldg., Washington, D. C.
11 Atlanta, Ga.	Auction	Q. M. Supplies	C.O., Q.M. Intermed. Depot, Candler Warehouse, Atlanta.
17 Springfield, Mass.	Sealed Bid	Office Equipment	Commanding Officer, Springfield Armory, Springfield, Mass.
19 Richmond, Va.	Sealed Bid	Water & Gasoline Cans	Chief, M.D.&S. Sect. Air Service, Room 2624, Munitions Bldg., Washington, D. C.
19 Norfolk, Va.	Auction	Q. M. Supplies	Q.M.S.O., Gen. Intermed. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.
21 Long Island City, N.Y.	Sealed Bid	Steel Lockers	Chief, M.D.&S. Sect. Air Service, Room 2624, Munitions Bldg., Washington, D. C.
24 San Antonio, Tex. Coronada, Calif. Fairfield, Ohio	Sealed Bid	Shotgun Shells & Clay Pigeons	Chief, M.D.&S. Sect. Air Service, Room 2624, Munitions Bldg., Washington, D. C.
25 Schenectady, N.Y.		Q. M. Supplies	Q.M.S.O., Gen. Intermed. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.
27 Ft. Mason, Calif.	Auction	Q. M. Supplies	Q.M.S.O., Gen. Intermed. Depot, Ft. Mason, San Francisco, Calif.
2 Houston, Texas	Sealed Bid	J-1 Airplanes	Chief, M.D.&S. Sect. Air Service, Room 2624, Munitions Bldg., Washington, D. C.
4 Atlanta, Ga.	Auction	Q. M. Supplies	C.O., Q.M. Intermed. Depot, Atlanta.
8 Houston, Texas	Sealed Bid	Aero Engines	Chief, M.D.&S. Sect. Air Service, Room 2624, Munitions Bldg., Washington, D. C.
9 Morrison, Va.	Sealed Bid	Airplane Hangars	Chief, M.D.&S. Sect. Air Service, Room 2624, Munitions Bldg., Washington, D. C.
9 Jeffersonville, Ind.	Auction	Q. M. Supplies	Q.M.S.O., Gen. Intermed. Depot, 1819 W. Pershing Rd., Chicago.
10 Erie Proving Grounds, Pa.	Auction	Ord. Material	C.O., Erie Proving Ground, Erie, Pa.
11 Chicago, Ill.	Auction	Q. M. Supplies	Q.M.S.O., Gen. Intermed. Depot, 1819 W. Pershing Rd., Chicago.
16 New Cumberland, Pa.	Auction	Q. M. Supplies	Q.M.S.O., Gen. Intermed. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.
18 Philadelphia, Pa.	Auction	Q. M. Supplies	Q.M.S.O., Gen. Intermed. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.
22 Nitro, West Va.	Auction	Ord. Material	Sales Control Committee, Nitro, W. Va.
25 Atlanta, Ga.	Auction	Q. M. Supplies	C.O.Q.M. Intermed. Depot, Candler Warehouse, Atlanta.
31 Brooklyn, N.Y.	Auction	Q. M. Supplies	Q.M.S.O., Gen. Intermed. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.

Change in date of Atlanta Sale from April 13 to April 11.

ARTMENT

(Continued from page 83)

he could not read his instruments properly. Shortly after this his legs were paralyzed, and then his arms, though he could still move his head. Then his sight failed entirely and afterwards his hearing, and he became unconscious. His companion meanwhile found that his arms were paralyzed, but that he was still able to seize and pull the rope of the valve with his teeth. Enough gas was thus permitted to escape to cause the balloon to descend, when both quickly recovered.

An altitude effect that is often not recognized as due to the action of rarefied air is sleepiness. The flyer gradually becomes dull and sleepy, has no distress and so insensibly becomes so inefficient that he does not realize his condition.

Another influence of altitude that is unfortunate, especially in time of danger, is the impairment of the intellect and judgment. It is because of this that the airman often has an unwarranted sense of security and well-being. He is liable to be possessed by a fixed idea, such as that he must go still higher or stay where he is indefinitely. Birley reports an interesting case of a pilot who met an enemy patrol at 18,000 feet. "He did not realize his danger, but waved his hand to them in spite of the protests of his observer." At this stage there may appear various forms of uncontrolled emotion such as giggling, laughter, or singing. A statement made by Schroeder after one of his altitude flights illustrates the influence on the intellect: "But lack of oxygen was affecting me, I was beginning to get cross, and I could not understand why I was only at 29,000 feet after climbing for so long a time. I remember that the horizon seemed to be very much out of place, but I felt that I was flying correctly and that I was right and the horizon was wrong. About this time the motor quit. I was out of gasoline, so I descended in a large spiral. When I had descended to about 20,000 feet I began to feel much better and realized that the lack of oxygen had affected me."

Impairment of vision and hearing also comes on gradually and insensibly. Schroeder in his altitude flight to 28,900 feet recorded an experience of this as follows: "When I reached 25,000 feet, I noticed the sun growing very dim, I could hardly hear my motor run and I felt hungry." He then took oxygen, and says: "As soon as I started to inhale the oxygen the sun grew bright again, my motor began to exhaust so loud that it seemed something must be wrong with it. I was no longer hungry, and the day seemed to be a most beautiful one."

In addition to these experiences fainting is not uncommon at a high altitude. It was found during the war that among the men flying at the front an aviator who had flown in comfort and efficiently at 18,000 feet several hours a day for some weeks, might suddenly find his "ceiling" less high. This was usually associated with "staleness." Like the athlete the aviator may "go stale," and in this case he becomes more sensitive to want of oxygen and particularly liable to fainting in the air. Cases have been reported of men who, when in this condition, daily found themselves affected by lower and lower altitudes; their ceiling was gradually coming down. To continue flying at high altitudes was to court death. Few men who faint in the air live to tell their story, but some have done so, and recovered sufficiently during the descent to regain control of the aeroplane. Several cases are known of men who on fainting crashed but escaped injury.

The human body is delicately sensitive to the changes in the oxygen content of the atmospheric air. While it may lose efficiency as the altitude increases, it yet has power to adjust itself to some extent to the decrease in the oxygen supply. The ability to endure altitudes without loss in efficiency is dependent upon the ease and the quickness with which the adaptive adjustments are made. There are marked individual differences in this respect. Some men adjust so readily and well that they are not disturbed by elevations which will render the average person uncomfortable or inefficient. A few men fail entirely to respond, and become inefficient at relatively low altitudes; thus during the war an occasional aviator experienced a headache and blurring of the vision at a height of 6,000 feet. On the other hand, a considerable percentage of the war flyers carried on their work well at 20,000 feet.

While physiologists had studied the effects of altitude on men living on mountains, yet at the beginning of the war we did not know much about the altitude effects of flying. The need of this knowledge was recognized by the leaders of our Army Medical Corps, with the result that in November, 1917, a group of scientists began investigations of the physiological and psychological effects of altitude on aviators. During the early days of the war, plans were set in motion by Dr. Yandell Henderson, of Yale University, to design and construct apparatus which would stimulate high altitude conditions. This has been accomplished in two ways, by means of a low pressure steel chamber and a rebreathing apparatus.

By means of such apparatus much of the exact knowledge of the physiology of aviation at high altitudes has been obtained. It has been shown that adaptive changes do occur in the body of the aviator as he ascends, but that the changes are limited in extent; and that as the limits of the powers of

adjustment are approached or exceeded the man becomes mentally and physically inefficient. Such adaptive changes occur are clearly for the purpose of providing an adequate supply of oxygen to the nervous system, heart, muscles, and other parts. The aviator, as a rule, is not conscious of these changes which take place in the breathing, circulation, and composition of the blood.

The adaptive breathing response begins in some aviators as low as 4,000 feet and in the majority at approximately 8,000 feet. The quantity of air inhaled becomes larger each minute, and the depth of each breath becomes greater with ascent. The man who gradually increases the quantity of air inhaled as the ascent is being made, will endure to a higher altitude than he who fails to make the breathing adaptation.

The second adaptive reaction to altitude occurs in the circulatory system and causes a more rapid flow of blood. This is accomplished chiefly by an acceleration in the rate of heart beat, and a slight change in the diameter or size of the blood vessels. Consequently the heart pumps more blood each minute, thus carrying more oxygen to the organs of the body.

There is a third adaptive change which is not so certain to occur and is a slower process. The oxygen that enters the blood combines chemically with the red coloring matter, the haemoglobin, in the red corpuscles. If an aviator remains for hours at an altitude of fifteen thousand feet, his blood may show an increase in the number of red corpuscles and the amount of haemoglobin. This, of course, permits a unit volume of blood to carry more oxygen than it normally carries.

It is quite evident, therefore, that the adaptive changes are such as should adequately meet the body need of oxygen from a decreased oxygen supply. The breathing gradually and unconsciously becomes deeper, thus increasing the amount of air that enters the lungs each minute. The heart beats more rapidly, and drives more blood with its load of oxygen to the organs of the body each minute. And lastly, the blood becomes more concentrated so that a given unit is capable of carrying more than the usual amount of oxygen. The more perfect these three reactions, the better the man will withstand the altitude. But the capacity of each of these mechanisms is limited.

For each aviator there is an altitude beyond which he cannot go without compelling his nervous system and muscles to work at great disadvantage because of an insufficient supply of oxygen. When this elevation is reached, impairment of vision, hearing, intellect and judgment and difficulty in concentrating the attention will be experienced. If an aviator is flying at this height with a squadron in a formation, he will begin to lag behind and by so much reduce the general level of efficiency of his group. Twenty-three thousand feet is about the limit of consciousness for the man adapted to life at sea-level.

Flying at altitudes higher than those to which the body easily adapts itself entails a serious strain, probably on the central nervous system. Frequent flights to extremely high altitudes eventually bring on flying staleness.

In the air service of our army the flying personnel is from time to time examined with the rebreathing machine method to determine how well each individual reacts to the influence of altitude. The results show that from fifteen to twenty per cent of all men are unfit to fly to 15,000 feet, and that it would be safer if they confined themselves to altitudes of less than 10,000 feet. About forty per cent of the American aviators have compensated very well to low oxygen and are apparently able to fly at 20,000 feet without mental and physical deterioration.

It is possible to offset the effects of altitude by supplying the flyer with pure oxygen that is carried in steel tanks under great compression or as a liquid. The freedom with which oxygen enters the blood from the lungs and passes from the blood to the tissues is determined by the density or pressure of oxygen in the air and in the blood. The greater the amount or the higher the pressure of oxygen, the more adequately will the tissue needs be supplied. If, therefore, the aviator breathes pure oxygen, even though its pressure be that of the atmosphere at a particular altitude, this will permit the blood to take up more of the oxygen. An experiment in the low pressure chamber with a man taken to 20,000 feet illustrates the beneficial action of oxygen. At this height he was breathing deeply, inhaling about a quart and a half of air with each breath; his heart was beating 112 times a minute, and the blood pressure was equal to 140 millimeters of mercury. One minute after he began breathing pure oxygen each breath contained less than a pint of air; the heart beat 80 times a minute and the blood pressure was back to normal, 122 millimeters.

In one experiment two men went into the steel low pressure chamber while the air was pumped out until the barometer indicated an altitude of almost 35,000 feet. They were supplied with oxygen from an oxygen tank through tubes and mouthpieces during the entire experiment. The breathing, the heart, and the circulation were unaffected; and the men ex-

(Concluded on page 95)



NAVAL *and* MILITARY AERONAUTICS



22nd Squadron to Have a Busy Summer

Plans have been received for the Commanding General of the Fourth Corps Area in regard to the proposed work of the 22d Squadron during the summer. The squadron will take charge of the instruction of the R. O. T. C., Air Service, which camp will be located at the Montgomery Air Intermediate Depot, Montgomery, Ala. The squadron will also work with the Citizen's Military Training Camp, which will be located either at Camp Benning or at Camp McClellan, Anniston, Ala. It will also take care of all the aerial observation for the National Guard Camp at Camp McClellan. It is planned for the National Guard Field Artillery to be stationed at Camp McClellan, which will give the observers and pilots of this squadron an opportunity to work with that unit in the adjustment of their guns. The Engineers have made request for the squadron to photograph areas on the Gulf of Mexico.

137th Observation Squadron, I. N. G., to Receive Regular Army Instruction

The 137th Observation Squadron, Air Service, Indiana National Guard, stationed at Kokomo, will receive Regular Army instruction, under Captain William F. Donnelly, who has been designated by the War Department as permanent instructor. Captain Donnelly is an experienced flyer, and will do much toward whipping the outfit into condition.

The Medical Detachment, to which this unit is entitled, has been formed during the past week. Dr. H. M. Rhorer has been appointed Flight Surgeon with the rank of 1st Lt.

Equipment is still coming in daily, and the entire Squadron of 137 men is now completely outfitted. The trucks and motorcycles have been allotted, and will be driven to Kokomo as soon as road conditions will permit. Bad weather has delayed the construction of the two new hangars, so that the nine ships which have already been issued will not be set up immediately, but by early summer the organization will be in good shape for intensive training.

Progress of Air Service Observation School at Fort Sill, Okla.

The third class for the Air Service Observation School at Post Field, Fort Sill, Okla., reported shortly before the 15th of January. The class is made up of 15 Air Service officers, one officer from the Chinese Navy, and one cadet. All of these came from Carlstrom Field, where their primary training had been completed.

Work began on Monday, January 16th. The mornings for the first week were devoted exclusively to transition flying in DeHavilands. The afternoons were spent in the Motor Overhaul Shops, where the student officers personally tore down and reconstructed three Liberty engines, later testing them on the blocks, and "shooting trouble." These engines are to be installed in certain designated ships, and each student will fly one of the ships equipped with

his own handiwork. Needless to say, great efforts were put forth on these engines by all concerned.

The course is now in its sixth week. The first four weeks were devoted strictly to flying and Liberty engines. Good progress has been made by all. The examination on engines was very practical. The ignition, cooling, lubrication, and gasoline feed systems were all very thoroughly covered, and a thoroughly practical knowledge of the subject was absolutely necessary to obtain a passing grade. The fact that all obtained a grade of "better than 90%" indicates the spirit of the class.

The fifth and sixth weeks have been devoted to flying and rigging, an equal amount of time to each. As in the case of Liberty engines, the work in rigging is practical, consisting of actual work on a ship—fitting and equipping it completely from the time it leaves the crate until it is placed in commission. This ship will also be flown by the class.

Beginning the seventh week and lasting until the end of the fifteenth week, theory will be combined with practice. The flying period of three hours each day will be taken up by flying the missions described and explained in the class room.

From the fifteenth week until the twenty-third and last week of the course, flying exclusively will obtain. During this period, formation flying and cross-country work will predominate. As in the last course, it is contemplated that each student will make a cross-country trip requiring at least two hops each way, the student to take a mechanic and to rely solely upon his own resources as far as navigation and flying are concerned.

Carlstrom Field Has Aviation Meet

The Field Meet at Carlstrom Field, Arcadia, Fla., Friday, February 24th, started off with a bang, and there was not an idle moment during the entire afternoon. The show was opened with a DeHaviland formation over the field at low altitude. Mr. Art Smith, the famous civilian aviator, who is an instructor at the field, dazzled the crowd with a fine exhibition of stunt flying. He flew a Nieuport scout with smoke bombs attached to the upper wings, and made a very pretty effect. The speed race for all models was thrilling, and was won by Lieut. Hez, McClellan in a DeHaviland. There were ten other events, and the two thousand spectators went away well satisfied, loud in their praise of the Air Service and more determined to keep Carlstrom which, from present indications, is destined to be abandoned and the school transferred to Kelly Field.

An event which marred the otherwise successful completion of the Meet was the death of Staff Sergeant Robert C. Washborne, who jumped with a parachute from an altitude of 3,000 feet and fell to his death because his parachute failed to open. The cause of the failure has not been determined, but a board has been convened to determine the cause of the accident. The chutes were of the Floyd Smith type, were new, and had been received from McCook

Field for this particular event. Sergeant Washborne was an experienced man with parachutes and had made several successful jumps. He was a graduate of the Air Service Mechanics School, Kelly Field, Texas, and had successfully completed a course in parachute repairing and maintenance. An impressive funeral was held on the field on Saturday afternoon, Chaplain Maurice Reynolds officiating.

An Airman's Memorial at Princeton University

There is to be erected at Princeton University an artificial skating rink as a memorial to the late Lieut. Hobart A. H. Baker, the famous Princeton football and hockey player, who during the war was a member of the Lafayette Escadrille and later Commanding Officer of the 141st Aero Squadron, and who was officially credited with bringing down three enemy planes, was decorated with the Croix de Guerre for "exceptional valor under fire," and met his death accidentally in a flight at Toul on December 26, 1918. The Baker Memorial is to be a Gothic building which will be a credit to Princeton architecture, and the erection of same has been made possible through the donation of \$100,000 by an anonymous contributor. The estimated cost of the structure is \$250,000 and with the \$100,000 already assured, donations for the additional \$150,000 are being obtained.

Florida Beacons Established

On January 17, 1922, the following beacons, each an unpainted rectangular slatted daymark above a yellow platform on a pile 8 feet high, were established at Pensacola Naval Air Station, East Bay:

Beacon A, surrounded by three brace piles, located 1,250 yards 98° from East Bay Channel Range Front Light.

Beacon B, surrounded by three brace piles, located 3 miles 6° 30' from Beacon A.

Beacon C, located 3 miles 125° 20' from Beacon B.

Approximate position of East Bay Channel Range Front Light, latitude 30° 31' 45" N., longitude 87° 01' 45" W.

Test Flight of MB-VII at Mitchel Field

For several days there has been much anticipation as to what the new MB-VII aeroplane, which was being set up at Mitchell Field, would show on its initial flight. This ship, the first of its type to be set up, is a monoplane, powered with a 300 h. p. Hispano-Suiza motor. On Thursday afternoon, February 23d, this small plane was given a short initial flight. No information was given out officially as to the performance of the plane, but those who saw it in flight are of the opinion that this plane will develop unusual speed. It was also noted that the monoplane had a very high landing speed. Many of the pilots of the field are hoping for an opportunity to fly this speedy little bus.



FOREIGN NEWS



Air Craft Introduce a New Era

An address of great significance to foresters and of great interest to the public was given by Ellwood Wilson, Chief Forester to the Laurentide Company, Grand Mere, Quebec, at Toronto, recently. Hydroplanes employed in his work scout for fires, inspect logging operations, make maps and estimates of timber areas. Mr. Wilson said: "The two great needs of Canada to-day in the management of her all important forest resource is its protection from fire and an estimate of its extent and amount. This would have taken years of work, but with aircraft it can be completed in a very short time; witness the work done by the Air Board for the Ontario Government at English River this past season."

"In this country of poor communications and enormous distances, aircraft offer almost the only means for quickly and accurately reporting fires and getting assistance to extinguish them. A scheme for doing this has been carefully worked out, and will be given a thorough try-out in the spring."

"Those who have experience with aircraft feel that a new era has dawned in the proper management of our forests based on the knowledge gained from the air."

British Air Policy

A question much discussed lately—to what extent developments in aviation may make naval warfare obsolete—was raised in the House of Commons March 16 in a debate on the naval estimates. Austin Chamberlain, Lord Privy Seal, outlined the present policy of the government on the question.

Mr. Chamberlain said he could imagine circumstances might soon lead the world to believe that limitation of battleships or armament would be of little use unless similar limitation was placed on aircraft. Therefore, he could only declare the government's policy as things stood at present.

Believing, as the government did, that the air force had immense potentialities, quite distinct from its duties as an adjunct to the naval and military services, and convinced that in the future the greatest danger to Great Britain might well be from an action by air forces, the government considered it would be a retrograde step to abolish the Air Ministry and re-absorb the air force into the Admiralty and the War Office.

Mr. Chamberlain announced that the standing committee of the Committee on Imperial Defense, after long and careful inquiry, had arrived at the following conclusions:

First—That the air force shall be autonomous in matters of administration and education. Second—In case of defense against air raids the army and navy must play a secondary role. Third—In case of military or naval operations the air force must be in strict subordination to the general or admiral in supreme command. Fourth—In other cases, such as the protection of commerce and an attack on enemy harbors and inland towns, the relations between the air forces and the other services shall be regarded as a matter of co-operation.

Mr. Chamberlain added that the government had decided to appoint a committee to advise further how to secure the utmost efficiency in the air service.

Aeroplanes and the Fur Industry

The isolation of the Labrador Coast was broken on March 12th, when Major Cotton, Ex-R. A. F., landed in his aeroplane at St. John's Nfld., completing a round trip 800 miles up the Labrador Coast. Up to this time, communication between Labrador and St. John's has been impossible from the time the ice sets in—late in October, until about July 1st. Major Cotton made the trip in spite of a blizzard, low temperature and soft, deep snow, bringing with him mail and a package of furs for Charles S. Porter, Inc., N. Y., who maintains a fur trading post at Cartwright. It is the hope of Major Cotton to interest the authorities to establish regular service flights to carry mail and bring out the fur catch which is the most valuable product of the Labrador Coast, in time for the April Fur Sales. Under ordinary conditions these fur collections do not reach the market until August.

British Civil Aviation Advisory Board

The Civil Aviation Advisory Board, the creation of which was announced by the Under-Secretary of State for Air at the recent Air Conference has now been set up with the following terms of reference:—"To advise generally on the development of Civil Aviation and to report upon any specific point which may from time to time be referred to the Board by the Secretary of State for Air."

The constitution of the Board is as follows:—The Under-Secretary of State for Air (Chairman: The Rt. Hon. Lord Gorell, C. B. E., M. C.); The Controller-General of Civil Aviation, Air Ministry (Major-General Sir Frederick H. Sykes, G. B. E., K. C. B., C. M. G.); The Director General of Supply and Research, Air Ministry (Air Vice Marshal Sir W. G. H. Salmond, K. C. M. G., C. B., D. S. O.).

Representatives of General Post Office: (Brigadier-General F. H. Williamson, C. B. E.); Air League of the British Empire (Major-General Sir W. Sefton Brancker, K. C. B., A. F. C.); Association of British Chambers of Commerce (Mr. Edward Manville, M. F.); Federation of British Industries (Mr. H. James Yates); Lloyds (Lieut-Colonel Sir Frederick Hall, K. B. E., D. S. O., M. P.); Royal Aero Club (Brigadier-General Sir Capel Holden, K. C. B., F. R. S.); Royal Aeronautical Society (Lieut-Colonel Mervyn O'Gorman, C. B.); Society of British Aircraft Constructors, Limited (Sir Henry White Smith, C. B. E.); Mr. F. G. L. Bertram, C. B. E. (Secretary Air Ministry).

Arrangements have also been made for consultation, when required, with representatives of the Dominions.

The Secretary of State has decided to refer to the Advisory Board, as the first subject upon which he desires its recommendations, the question of the cost and practicability of an Imperial Air Mail Service.

German Air Companies Expect a Big Season

German air travel and transport companies are busy making final arrangements for opening their 1922 passenger, postal and freight services. There are seven such companies, which in the seven flying months of 1921 carried 6,820 persons and 30,710 kilograms of luggage and postal parcels. The total distance covered by the companies' aeroplanes was 1,650,000 kilometers. Most of their services will be resumed on April 1. On May 1 connections with international lines will be taken up, and a few other routes will be opened on July 1.

The chief line of all is to be the Copenhagen-Hamburg-Berlin-Dres-

den-Prague route, right through Central Europe, and it is planned to continue that line on and after July 1 via Vienna, Belgrade and Bucharest to Constantinople. The Copenhagen-Prague section of it will be operated in co-operation with Danish and Czech companies. From Königsberg a route to Memel will be opened and continued to Riga and Reval. Königsberg and Riga are to be linked up with Kovno, and from there a service to Moscow will be opened on May 1. The Soviet Government has already given its sanction, and Lithuania and Latvia, which are also interested, have approved the scheme.

The Russian Government has granted a monopoly to a German company for operating air services between the most important Russian cities. In the near future regular service between Petrograd and Moscow for post and passengers will be begun, and that will be followed by one between Moscow and Kiev. A Petrograd-Berlin air service is also under consideration.

Works for the manufacture of aeroplanes are nearing completion in Moscow and Petrograd, and all those run by the Russo-German companies will continue their policy of opening special services to centers where there are special attractions; for example, to Oberammergau, with its Passion Play, and to the various cities which are holding industrial fairs. They expect to break their 1921 record handsomely.

The fares on all the German routes will be approximately those for first-class railway travel. For aerial journeys to neighboring countries the charges will of course depend on the rate of exchange.

Definitions and Nomenclature of Aircraft

The following definitions will be used officially from March 1st by the British Air Ministry:—

(1) Aeroplane.—Any aircraft heavier than air, with fixed wings, driven mechanically.

(2) Aeroplane is a generic term and includes:—(i) Amphibians; (ii) Seaplanes; (iii) Landplanes; denoting respectively aeroplanes designed to alight on or take off from: (i) Land or water; (ii) Water; (iii) Land.

(3) Seaplanes include Float Planes and Flying Boats, denoting respectively seaplanes fitted with floats or hull.

(4) Landplanes designed so as to facilitate their landing on a ship's deck will ordinarily be known as Ship Planes.

Aeronautics in Australia

A correspondent of the London Times states that arrangements are being made by the Australian Government to establish this year two aerial defense bases, in Victoria and New South Wales. Developments in this direction have recently been facilitated by the acquisition by the Commonwealth Government of 128 aeroplanes of various types as a gift from the British Government.

It is the declared policy of the Australian Government to establish aerial defence bases in all the States of the Commonwealth as finances permit, and with this object in view the Victorian base is to be constructed so as to form a headquarters for all the State units. Here there will be a large depot for equipment and stores, and a training school for pilots, observers and aerial gunners.

Plans are also being made to establish a seaplane unit at Sydney to work in co-operation with the Navy. Nearly all the equipment needed for this unit has been given by the British Government.

Activities in Finland

The American Consul at Helsingfors, Mr. L. A. Davis, states that during 1921 there were two commercial aviation companies operating in Finland, the Flyg A/B and the Flygtrafik A/B, a merger of which is now under consideration. The former operated two French Caudron hydroplanes, one of which could carry two passengers and the other only one. These planes proving unsatisfactory for the purpose because of their construction were sold to the Finnish military authorities, and the company intends to procure new planes for next season. Flights aggregating 63 hours were made between April and September, when flying was stopped by unfavorable weather conditions; a total of 260 passengers was carried without accident. The Flygtrafik had no planes of its own, but rented a German Junker from a Swedish company, and carried about 200 passengers.

Owing to depreciation of Finnish currency and the consequent high cost of aeroplanes procured from abroad, an aeroplane factory for the military authorities was built last year in the dry dock division of Sveaborg, just outside of Helsingfors; some repair shops were already located there. It is intended hereafter to build in Finland some of the seaplanes needed for military purposes; but motors for these must be imported for the present, although a factory for the construction of motors is also under consideration. There is also a complete repair shop for aeroplanes at the military station on Sandhamn Island, where all military machines are brought for important repairs, new machines inspected and trial flights made.

In the spring of 1921 the Aero Club of Finland applied for membership in the Federation Aeronautique Internationale, and the application was granted at the annual meeting of the Federation in Madrid, October 26, 1921. Finland was represented at this meeting by the chief of Sweden's flying corps.

Military Aeronautics in Venezuela

Vice Consul S. J. Fletcher, at La Guaira, states that with the exception of a few exhibition flights made at Caracas, the capital, there have been no attempts to introduce civil or commercial aviation in Venezuela. For military aviation, a branch of the Venezuelan Army has been organized, known as the Infantry Aviation Company, made up of two officers and 62 men, with headquarters at Maracay, State of Aragua. During 1921 instruction in military aviation was given by 3 officers in the French Military Mission to 12 students, of whom 11 succeeded in flying alone, and 5 qualified as pilots.

The equipment consists of six Caudron and two Farman aeroplanes and two Caudron and two Farman hydroplanes. A considerable amount of machinery and equipment has been bought from the French Government, but the equipment on hand is considered insufficient, and instruction in flying has ceased, awaiting the purchase of further equipment which the instructors have recommended to be secured from France. Plans for improved landing fields and the establishment of several flying routes have been held up from lack of funds, and it is expected that the waning interest in aviation will prevent the passage of a sufficient appropriation to execute these proposals in the near future.

SOARING

FLIGHT

A Study of the Vulture and Golden Eagle

By H. J. Nordman

Member of Long Island Flight Association

THESE great soaring birds, the Vulture and Eagle, will eventually lead man to the solution of soaring flight. Their mode of flight solves the problem of remaining in the air with the least expenditure of force.

The life needs of the creature, here as everywhere, determine its kind of talent. The vulture, to make a living, must rise to a great height to gain a large field of observation, and must long remain there without fatigue.

Let us now consider the construction of the vulture. His weight is very great, his wings immense, both in length and breadth; his large proportional surface sustains him, and his great mass stores up momentum. So we see him after a few wing-beats at once begin to soar, climbing up in the air and floating there with no expenditure of force, save for the start and for guidance. Certain species of vultures, particularly the larger, upon a windy day, can actually leave their perch in the morning, travel many miles, spend the whole day in the air, and get back to their perch at night without a single beat of their wings.

In this family velocity is useful only to the smaller species, which are after a fashion the purveyors of the larger; therefore the Egyptian Vultures, the Turkey-Buzzards, the Urubus, having to execute more varied movements, expend much more force.

This is the way a Vulture spends his day upon one or the other continent:

The larger species, if they have neither eggs nor young ones, have spent the night perched among rugged or inaccessible rocks, where they gather for shelter from the wind. The Turkey-Buzzards and the Egyptian Vultures have been roosting in the lower rocks; they are less fierce and much more intelligent. The sun comes out and dries the dew collected on their feathers. The Vultures stretch their wings, limber up the joints and trim the growing quills with all the care that the maintenance of an essential organ needs. About seven o'clock there are many flappings of the great wings, but without quitting the perch; then they sink their heads between their shoulders and resume their sinister, forbidding look. Between 8 and 9 o'clock the breeze begins to rise. Once in a while the Vulture glances into the valley through those magnificent eyes, unique for their power, then with four or five great beats of wing he launches into space. He descends some fifty yards on rigid wings, and is then in full sailing flight. The smaller species, who are earlier risers, are already at work and searching for food.

The large Vultures sail at heights which vary with the species. The Tawny Vultures of South America generally keep at elevations of 500 or 600 yards in the air. They are scarcely visible from the ground. The Arrian Vultures and the Condors usually float much higher; they become quite invisible.

The Arrian Vultures survey the movements of the Tawny Vultures, who in turn have an eye upon the Egyptian Vultures, which latter again watch the doings of the Kites, and especially of the Crows.

In America the Urubus is watched by the Turkey-Buzzard, the latter by the Papa, and this last by the Condor.

As all these great birds of prey thus establish a complete network of observation over the earth, from the mere fact of mutual surveillance, just as soon as a meal is found all the neighbors close by start in that direction, at once followed by the others, and thus they assemble very rapidly.

The attitudes of these birds in the air are particularly worthy of attention. Their aspect when sailing upon a wind of about 11 miles an hour, which velocity is best adapted to exhibit their faculties, becomes a most interesting study of soaring flight without the flap of a wing.

It is clear that to rise upon so feeble a current of air they must spread all their surface. At this speed of 11 miles per hour the Egyptian Vulture holds his wings to an even straight line and slightly brings the tips of his pinions forward; the Tawny Vulture advances them so much that the angle produced in front is 165°; the Oricou or Nubian Vulture goes much further, to make a satisfactory sketch of his attitude in flight would require an angle of 140°.

The Great Tawny Vulture

In the Great Tawny Vulture we have a bird with a wing-spread of 8 feet or more and a weight of 16 pounds. This admirable living soaring plane has but three or four varieties which surpass him in size.

The dominant note in this flight, the remarkable feature, is the decided tendency to perform all required manoeuvres and evolutions by gliding and soaring flight, avoiding all performances which involve flapping of the wings. The Oricou and the Arrian are in the same category; they even exaggerate this tendency. All these large birds only beat the air when there is a dead calm, an atmospheric circumstance quite rare in Egypt, and as the slightest breeze suffices for their support it is rarely the tranquility of the air which keeps them at rest.

Rain troubles them much more than a calm; they seem to dread having wet wings. Great winds also disorder the economy of their mode of flight. They are proportioned to sail well upon an average wind, so when the wind freshens they begin to encounter difficulties, and when it blows a tempest they seek shelter and do not stir out. This results from the great breadth of their wings, a breadth which, by the resistance it offers, completely deranges their facilities for locomotion.

In order to encounter strong air currents, wings must be narrow; thus observe the Gulls, the Stormy Petrel, the Albatross, etc. In a wind where all aboard ship seek shelter, you will see them in full activity, chasing ardently and moving with ease—they are in their element. There is no beating the air. They are then, as it were, set on two rigid supports, much curved downwards, skimming the waves with astonishing precision, fingering it with their wing tips, rising and descending with the billows without ever being overtaken. These same birds in a wind of 11 miles per hour (a light breeze) are compelled to settle down on the water, to dabble around like ducks, while in this same wind the great land sailing birds sweep with ease those great circles which transport them, without fatigue, up to enormous heights.

The Vulture, then, is the bird which can utilize the feeblest current of air in order to obtain complete sustaining power.

The following performance has been witnessed not once but a hundred times:

At the abattoirs of oriental cities, Vultures are seen in great

numbers, waiting a propitious moment to get at their food, and sustaining themselves in the air meanwhile without a single beat of wing. They mount up out of sight, descend within 200 yards of the earth, advance against the wind, glide with the wind, slide to the right or left, cruising in a single hour over all the surrounding country to see if there be a dead animal more easy of access, and they perform these manoeuvres the whole day long, making twenty ascensions of 1,000 yards each, gliding over a hundred miles and all this without one single stroke upon the air.

(To be continued)



Egyptian Vulture. Weight, 4 pounds. Loading, wings only, 1 pound per square foot. Wing span about 5 ft. 4 inches.



To Dead Aviators

By EDWARD YERXA

Voyagers, how fares it where you are
Far from those restless warlit Gallic skies—
Do not the specter yesterday arise,
Dawn, white noon, and the pale evening star!

Conquerors of space like birds awing,
Amid the tumult of the heated fray
You lived in youth an age within a day—
What could a thousand eons to you bring?

No more than Honor's greeting at the gate,
The pathway to the stars that gleam the night,
And all you asked was but to do the right
Like any lad upon the Street called Straight.

Now flags are furled and the last bugle call
Is sounded and the muffled drums are still,
In peace the lamps are lit upon the hill
But many a lass will miss your firm footfall.

Pro Patria—the hectic day is done,
For Lafayette—the muster roll is read,
For France—you answer with your hero dead,
(How proud must be a mother in her son!)

Donors of all that life held to be good—
How fares Valhalla's lasting sunlit day,
In festive fields with jest and laughter gay—
At home amidst a gallant brotherhood!

"What's the latest news, Larry?"
"I'm not reading the news. Ah's lookin' for a job."
"But dat's the female column."
"Well, ain't ma wife a female?"—*Medley.*

Noble Line

Her Father—My daughter, sir, sprang from a line of Peers.
The Lover—Well, I jumped off a dock once myself.

—*Tar Baby.*

No Bawls!

"Well, of all the nerve," she said, slapping his face when
he kissed her.

"Well, then," he pouted, "if that's the way you feel about
it, get off my lap!"—*Frivol.*

Too Bad

Bear—Anything on your hip?

Cat—Sure.

Bear—What is it?

Cat—A birthmark.—*Banter.*

Query

How doth the gentle laundress
Search out the weakest joints
And always tear the buttons off
At most strategic points?—*Goblin.*

Just-So Stories

Gladys—Did you know that Alyce is very fond of Kipling?
Burnie (*who has been out with Alyce*)—Oh, is that what
she calls it?—*Widow.*

"Why do you feed your dog axle grease?"

"Because it helps his waggin'!"—*Beanpot.*

She: I'll never trust any man in the dark.

He (*after a scrap*): It's a cinch you have nothing to fear
in the daytime.—*Phoenix.*

Lovely Girl

"Listen, Abe, you don't want to marry that girl, why every-
body in town kisses her."

"Vell, the town ain't so beeg."—*Phoenix (Chicago).*

Old Joe's Flight

At last I weakly yielded spite of all,
Old colored Joe had pestered me so long;
And on the mildest, finest day last fall
Took up the nigger, happy as a song.

As off we got I heard him gulp an "Oh!"
But as I swiftly zoomed he settled back
As one contented, crooning soft and low:
"We'll see the pearly gates from dis old hack."

When up two thousand feet I leveled out
And at her topmost speed did let her go,
I heard Joe say as he peered round about:
"Why dis old eagle's stopped I like to know?"

But as I quickly took a spiral dive
A thousand feet or more then glided out,
In trembling voice he cried: "Specks I'm alive.
I feared ye couldn't bring the thing about."

I rolled around a while, then staggered down;
I looped and looped again, tail slid and spun;
While Joe's voice faintly floated o'er the town
"Like my old mules dis sut'enly do run."

Then last I tried the falling leaf descent;
I zoomed and fell with falls and starts until
I found Joe had collapsed; so I intent
On succor brought him down who now was ill.

I landed, listened, looking with affright
For signs of life; then heard him faintly pray:
"O Lord, if I's got to go to heaven to-night
Stid o' this send 'Lijah's chariot dis way."

They rushed about my ship, concerned to see
That Joe few signs of consciousness revealed.
One sought to rouse; another said: "Let be,"
And quickly gave him what his mouth unsealed.

"Captain, you sure drives dis contraption fast;
I's feared; yet fur another sip o' gin,"
He took once more a hard, strong pull, his last,
"Dis er poor cullud man 'd go up agin."

EDWARD DAY.

He (*inviting a stranger into a game*): Do you play square?
Stranger: Naw, I never heard of it.—*Octopus.*

When you tell a man something, it goes in one ear and out
the other; when you tell a woman something, it goes in both
ears and comes out of her mouth.—*Gargoyle.*

So 'Tis! So 'Tis!

Watch—What is a boob?

Fob—A boob is a man who kisses a girl fifteen minutes
after he meets her and then allows her to persuade him that
she has never been kissed before.—*Frivol.*

Candidly Speaking

Customer—I'd like a dollar's worth of kisses, please.

Clerk—Do you mind if they are burning hot?

Customer—Not at all, just so they are well done.

"The Duchess has a glass eye."

"How do you know?"

"I was talking with her the other evening and it came out
in the course of the conversation."—*Lampoon.*

She: What do fellows talk about after a dance?

He: The same things you girls talk about.

She: Oh! You horrid things.—*Siren.*

He (*telling joke*): Do you see the point?

She: If it is what I think it is, I don't, and you're no
gentleman.—*Wampus.*

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(Continued from page 84)

perienced neither discomfort nor any sensations that might possibly be due to the low pressure of such an altitude.

Scientists estimate that there is a limit to the protection that may be given to an aviator by the breathing of pure oxygen through an inhaler. The calculations place the limit at about 40,000 feet. Therefore, if man is to go beyond an altitude of 40,000 feet, he should wear a suit similar to the one used by the dep-sa diver, and receives his oxygen under a pressure greater than that of the atmospheric air.

Another effect that must be taken into account during flying is the temperature of the air. The intensity of the cold varies with the season and the height attained and is, of course, accentuated by the speed of flying. The average air temperature decreases slowly with elevation near the surface of the earth. During the first mile of ascent the temperature falls approximately one degree on the Fahrenheit thermometer in every 540 feet. From this height on, the rate of cooling is more rapid; at an altitude of from 14,000 to 16,000 feet the temperature falls one degree in approximately 360 feet, and then continues to fall more and more rapidly until it reaches a maximum rate at the altitude of from 23,000 to 29,500 feet when the thermometer registers a fall of one degree in every 188 feet of ascent. From somewhere between an altitude of 32,500 and 39,500 feet on into higher levels, the temperature of the air remains almost constant—at about 62 degrees below zero in summer and 71 degrees below in winter. Through the lower strata of the earth's atmosphere, the winter temperature averages 20 to 22 degrees below the summer temperature.

To-day the aviator protects his body against cold and wind by a careful and proper use of clothing and helmets. Special suits have been designed, the purpose of which is to keep the body surrounded by layers of warm air. Sometimes this air is heated by means of fine electric wires so placed and heated that there is little or no danger of burning. It has been found that the clothing should not fit too tightly, that two thin garments of closely woven texture are better than one thick one, and that there should be no orifices through which the outside air can permeate. A combination fur-lined suit and fur-lined boots make a satisfactory outer covering. In spite of such protection the body is called upon to respond to the external cold.

A final analysis of the prerequisites for the man who would become a pilot shows clearly that the aviator, especially if he is to make frequent flights day in and day out or to be serviceable in time of war, must be endowed with a nervous system

that can withstand wear and tear. Nervous breakdown was a frequent cause of failure among the army aviators of all the warring nations. Very often this developed surprisingly early. The British found that the pursuit pilots on the average were good for not more than 150 to 300 hours of war work in the air. At first the possibility of nervous breakdown was not recognized. It took several years of war experience to demonstrate that flying probably exposed the human body to a greater strain than it had ever undergone. Before this was recognized the flyers were not given sufficient rest or release from likelihood of being ordered into the air. As a result, the men were held closely to their posts until the breakdown became evident to all. The majority of such pilots were thereafter permanently unfit for air work.

Temporary indispositions such as follow a bad cold, recent illness, lack of sleep, overwork, and alcoholic excess attack unfavorably the alertness and keenness of the flyer, and often manifest themselves in loss of judgement. At such times a flyer may find that there is a return of his former condition of sensitiveness to motion, so that he becomes unduly dizzy in acrobatic stunts. Furthermore, if there is any tendency to an unbalanced action of the eye muscles, this may then become manifest and by interfering with judgment of distance render landing difficult. Excessive fatigue is a more dangerous foe

earth.

of the "birdman" than of the man who keeps his feet on the ground. It is quite evident that nature did not endow all men with the attributes essential for good flying. To be a reliable pilot under all of the vicissitudes of flight requires good eyes, healthy ears, a normal sensory equipment of the skin, muscles and viscera for equilibrium; a well-organized nervous system capable of withstanding fatigue; a brain capable of quick and accurate decisions; a body capable of compensation to altitude and to cold; and finally a body capable of rapid recovery from fatigue. These are not to be looked upon as the attributes of the superman, but only of a mere man who is normal in body and mind. The physical examinations of war days proved that America has a host of young men who fulfil the requirements. It is unwise to attempt to enumerate the component parts of a good aviator. Defectives and the nervously high-strung or those bordering on the temperamental often become good flyers, but no one places great reliance upon them. After a study of the fighting pilot returning from the war zone, Major Patten concluded that he should be absolutely normal physically and mentally—"a tall, short; stout, slim; blond, brunette; quiet, nervous; languid, alert; reckless, conservative individual."



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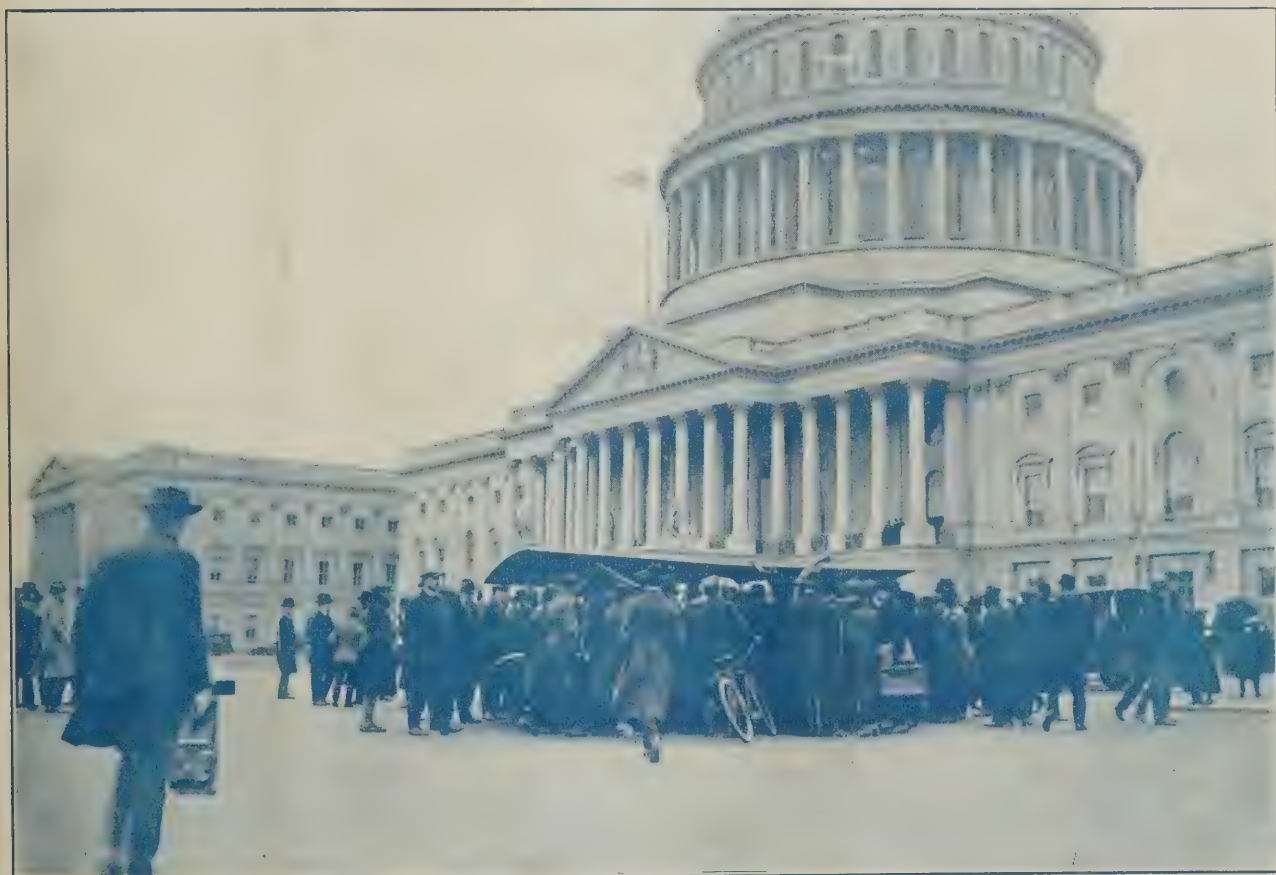
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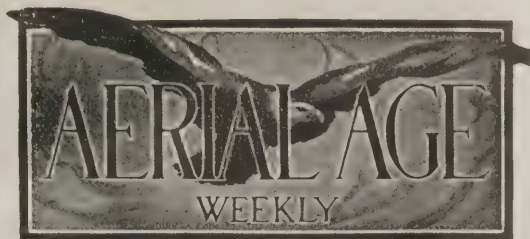
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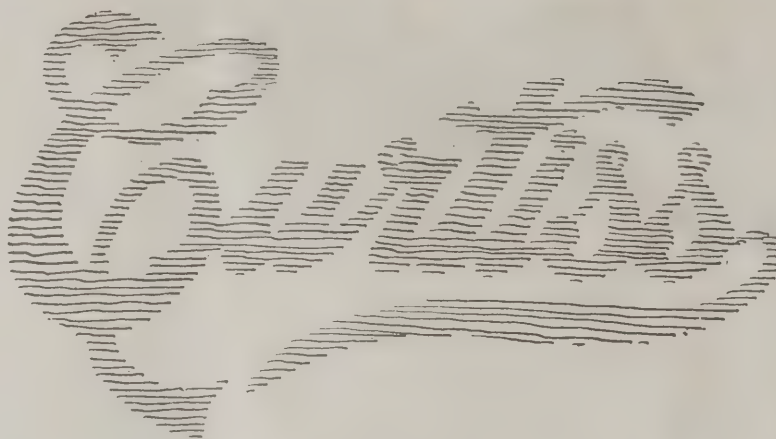
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No. 5

Engine Installation

STATISTICS indicate that about seven out of every eight forced landings of aeroplanes are due to breakdown not of the engine itself but to some part of the engine installation. This is proof, if such were needed, that the question of engine installation is one of the very greatest importance. The closest attention to engine installation is necessary if that regularity and safety is to be attained upon which the success of commercial aviation will depend.

We wonder whether designers really realize and fully appreciate the simplicity and other advantages of direct gravity feed from the main petrol tanks to the engine. Judging from the number of machines still flying in which one finds a superfluity of pumps, windmills, gravity tanks, piping, joints, etc., we should say that the majority of designers do not yet quite realize what a simple gravity system will do in the matter of simplification and, incidentally, weight reduction. It is true that of late there has been noticeable a tendency towards gravity feed, but still one finds new machines coming along in which this feature is not incorporated. There are very few designs in which it would not be possible, by a slight sacrifice of appearance, and possibly a certain amount of loss in aerodynamic efficiency, to employ direct gravity feed. The 18 inches of "head," which is the minimum at which the majority of carburetors will function, should be fairly easily attainable without necessitating other alterations than the placing of two petrol tanks (so as to avoid getting a tank immediately above the fuselage) on top of the top plane over the first pair of interplane struts of a biplane. This arrangement has been in use on a Spad-Herbemont type for a year or more with, so far as we are aware, excellent results. From the way in which this type of machine handles, it does not appear that the increase in moment of inertia due to this placing of the tanks in any way interferes with maneuverability. Certain machines have the tanks slung under the bottom plane. This arrangement, while being as safe from fire, and offering greater facility for hand-filling of the tanks, still necessitates the use of pumps, and as bulk storage of petrol is now the accepted method, the question of filling should not be allowed to prevent the high placing of the tanks.

Intimately connected with the question of engine installation is that of easy interchangeability. Almost the only type of engine which was readily accessible and quickly changed in the earlier days of flying was the rotary, mounted on a front plate

and having a second support somewhere on the fixed shaft. When the rotary type began to be supplanted, the water-cooled type was installed with but little regard to accessibility, and unfortunately this feature of the installation appears to have remained with us right up to the present time. A few attempts have been made to render the engine more accessible in the latest types of commercial machines, but with one or two exceptions we are, it is to be feared, still a long way from the ideal of an engine which can be changed for a fresh one in about two hours.

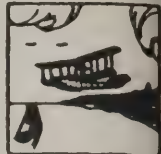
The Future Large Machine

IF we look back through the history of the development of the ship, we find that the general tendency, for craft intended for long-distance work at any rate, has been towards a constant increase in size. There came a time when it was thought that the limit had been reached, but this does not appear to be the case, and the development goes on, although more slowly. It may be admitted that, so far as can now be seen, there is little more to be gained in speed by surface craft, and it will be to aircraft that future generations will look for high speed of travel. It may not, therefore, be without interest to attempt to form a picture of the manner in which aircraft, and especially heavier-than-air craft, may be expected to develop. Here, as in the case of the ship, it is fairly certain that for long-distance work the tendency will be towards greatly increased size.

If we imagine a machine of about 50 tons total weight (and such a design has already been got out in Germany by Professor Junkers), with a thick, high-lift wing section, and assume a wing loading of 10 lbs/sq. ft., we arrive at a wing area of about 11,000 sq. ft. This high-lift wing will have a maximum thickness of about 18 per cent of the chord. If, now, we assume a maximum chord of about 40 ft. in the center, we arrive at a wing depth of about 7 ft. This means that there will be sufficient depth to place the engines, passenger cabins, tanks, etc., inside the wings, and it would therefore appear that it might be possible to suppress the fuselage altogether, or at any rate to reduce it to a couple of enclosed girders carrying the tail. If we imagine a folding undercarriage which disappears into the wings during flight, we arrive at the conclusion that the L/D of the whole machine might be as high as 15 or so. As that of the average machine of today is only about 7 or 8, the gain in efficiency would be very great indeed, reducing the power required by between one-half and one-third. The effect of this on the cost of air transport would be considerable, and the whole subject of the "giant" is one of extreme fascination. Its day is not yet, but it is coming.



THE NEWS OF THE WEEK



To Fly from Lisbon to Rio

Lisbon—Three Portuguese cruisers left March 25 to station themselves at different points in the Atlantic Ocean to act as a convoy for two Portuguese officers who will attempt to fly a hydroaeroplane from Lisbon to Rio Janeiro.

The date of the start of the flight has not been definitely fixed, but the aviators hope with favorable weather conditions they will be able to make the trans-Atlantic passage of more than 4,000 miles in sixty hours. The machine they will use will develop 360 horsepower and is expected to attain a speed of 80 miles an hour.

The route of the aviators will be from Lisbon to the Canary Islands, thence to the Cape Verde Islands, from there to Fernando Noronha, a short distance north-east of Pernambuco, and then southward to Rio.

Pescara Helicopter Ascends

Paris—At a private trial before a number of French flight experts and airmen Marquis Pateras Pescara on March 22 succeeded in raising himself with his helicopter to a height of six feet from the ground. The trial was made inside a big airship shed at Issy les Moulineaux and was considered more difficult than if it had been made in the open air, as the revolution of the lifting wings caused an enormous back pressure from the sides of the building. The inventor further handicapped himself by agreeing to rise and land within a circle ten meters in diameter.

At the first attempt the helicopter, which is the same as that tested at Barcelona last Summer, rose fifty centimeters. It was found that the engine had got too hot. When the air in the building was cooled a second attempt was made, and the marquis rose to a height between three and five feet several times in succession, always landing within the prescribed circle, although the helicopter showed a tendency to tilt backward. At the third attempt it rose vertically to a height of two meters and landed without the least shock. The only fault found by the experts was the tendency of the machine to tilt backward on landing; and this, it was explained, was more the fault of the inventor, who is not an expert pilot, than of his machine.

The Marquis is completely satisfied with his achievement and intends to begin the construction of a second machine which, as well as rising vertically, will be capable of lateral flight.

Flying Club Names Field for Albert Bond Lambert

The Flying Club of St. Louis at a dinner meeting recently voted to name its field at Bridgeton, Mo., in St. Louis County the Albert Bond Lambert Field in honor of Albert Bond Lambert, president of the Lambert Pharmacal Company and a St. Louis airman of national prominence.

Judge Daniel G. Taylor, vice president of the Missouri Aeronautical Society, an organization with which Lambert has long been affiliated, made the principal address. He mentioned Lambert's conspicuous service for aeronautics in Missouri and spoke briefly of the record which the Flying Club has made.

A number of flyers from Scott Field attended. Among the speakers were Maj.

A. E. Stocker, commandant of the aerial reserves in St. Louis. About seventy-five attended the meeting.

The program was concluded with the official air service moving pictures of the bombing tests carried out in Hampton Roads last summer.

British Airship Is Offered to Us

London.—A proposal for the participation of the United States Government in the purchase of one of the British airships was made March 22 by Major G. H. Scott, pilot of the R-34 on her two successful transatlantic flights, to Commander White, one of the Naval Attaches here. Commander White has transmitted the suggestion to Washington.

Major Scott expressed his willingness, The New York Times correspondent understands, to negotiate the taking over of the airship from Great Britain if he receives American backing to raise and train a crew here and navigate the ship himself across the Atlantic. He believed he could interest British financiers in the plan, but it would be necessary to ascertain the attitude the United States authorities would assume toward the project before entering upon financial details.

The British Government has at present five airships, the R-33, R-36, R-37, R-80 and L-71.

Of these the R-36 is fitted up as a passenger ship with sleeping and dining equipment, while the L-71, which was taken over from the Germans, needs a new gas bag. They are all now for sale without restriction, after the British Government had come to the conclusion that it could not afford to run airships as a part of its military equipment.

Navy Exhibits Model of Pulitzer Winner

Washington—A model of the Curtiss-Navy racer, winner of the Pulitzer Trophy race at Omaha on Nov. 3 of last year, has just been presented to the Navy Department.

The plane is a joint production of the Curtiss Company and the Navy Department, built for the navy. This speedy plane is powered by a new twin six Curtiss engine.

In the Pulitzer race the plane was piloted by Bert Acosta for the Curtiss Company. Acosta covered the 150 mile course in 52 minutes 9 3-5 seconds, or at an average speed of 176 miles per hour.

Acosta was the first to get away in the race, and at no point lost his lead. Naval flying experts were greatly impressed with the performance of the Curtiss-Navy racer, which was loaned by the Navy Department to the Curtiss Company to be flown in the Pulitzer race.

Amundsen Tests Plane

Capt. Roald Amundsen, the arctic explorer, who left Mineola Field in a Larsen monoplane shortly after noon March 30, reached Bolling Field at 2:55 o'clock the same day. Some rather severe weather was encountered on the trip from New York to Washington. For about 150 miles after the plane left Philadelphia snow and sleet with rains were encountered, the weather was quite thick and it was necessary for the pilot to fly the plane just over the housetops in the trip. Near Baltimore, however, the weather cleared up and the

trip was made with comparative quickness on to Washington.

Amundsen will take this machine into the Arctic when he starts his long drift across the polar regions next summer. John M. Larsen, owner of the model, has presented the plane to Amundsen and the explorer has expressed great satisfaction at obtaining a machine which has created such a marvelous endurance record.

Mapping Air Route from U. S. to Canal Zone

The War Department is working out an air route from the United States to the Panama Canal Zone by way of Havana. The plan is part of the defense plans of the zone, which include the establishment of an elaborate air base there.

The plan is to establish a base by arrangement with Cuba at Havana, from which point it is believed the airmen could hop off to British Honduras and thence to Costa Rica, making the Canal Zone on the last lap. This would obviate the necessity of arranging for a landing base in Mexico.

Spokane News

Spokane, Wash.—The Litzenger Brothers, Endicott wheat farmers, landed in Spokane by aeroplane recently to secure a competent woman cook for their farm operations. They had planned to take the successful applicant back with them via the air lanes, but the idea of daring the high places did not appeal to the material available and more prosaic methods of transportation were insisted on.

Fourth Aviators' Ball

Plans for the fourth annual aviators' ball, to be held at the Hotel Astor on Monday evening, April 24, are rapidly swing-

COMING AERONAUTICAL EVENTS

AMERICAN

- Apr. 30.—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.
- May —National Balloon Race.
- Sept. 4.—Detroit Aerial Water (about) Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
- Sept. 15.—Detroit Aerial Derby, (about) Detroit. (Pulitzer Trophy Race.)
- Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

- Aug. 1.—Coupe Jacques Schneider. (about) (Seaplane speed race.) Italy, probably Venice.
- Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.
- Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

ing into shape, and give promise of making the ball, as it always has been, a brilliant close to the Winter's social season. The patronesses and the committee chairmen include Mrs. Charles Dana Gibson, head of the patroness committee; Barbara Brockaw, of the junior committee; Emily Chauncey, of the entertainment committee; J. Philip Roosevelt, of the Army aviators' committee; H. Rogers Benjamin, of the Naval aviators' committee, and Emerson MacMillin, treasurer of the hall.

Other patronesses are Mrs. Laurence La F. Briggs, Mrs. R. Drace White, Mrs. Edward Breitung, Mrs. Rogers Benjamin, Mrs. Henry S. Zuckerman, Mrs. Donn Barber, Mrs. Charles T. Barney, Mrs. Guterson Borglum, Mrs. Marie Bernard, Mrs. Elihu Chauncey, Mrs. John Daniel, Mrs. Charles de Rham, Mrs. Nelson Doubleday, Mrs. Henry H. Flagler, Mrs. Lytleton Fox, Mrs. R. Horace Gallatin, Mrs. Henry F. Godfrey, Mrs. Enrico Caruso, Mrs. Jay Gould, Mrs. Emanuel Gurlier, Mrs. E. M. House, Mrs. Otto Kahn, Mrs. Goodhue Livingston, Mrs. John Lee, Mrs. John Purroy Mitchel, Mrs. John B. Marsh, Mrs. J. P. Meuer, Mrs. Lewis Gouverneur Morris, Mrs. James Lowell Putnam, Mrs. George B. Post, Mrs. H. Rivington Pyne, Mrs. Monroe D. Robinson, Mrs. Theodore Roosevelt, Jr.; Mrs. Phillip Rhinelander, 2d; Mrs. Malcolm Sloane, Mrs. Morton J. Schwartz, Mrs. George B. St. George, Mrs. Samuel Wagstaff and Mrs. Henry Rogers Winthrop.

Among those who will serve on the junior committee are Barbara Brokaw, Elizabeth Andrade, Ellin Mackay, Jeanne Reynal, Helen Meurer, Alice Beadleston, Louise Wilson, Marion de Rham, Gabrielle Gourde, Margherita De Vecchi and Mrs. Thomas Finletter.

Plan Air Service to Atlantic City

Regular daily air service between the Ritz-Carlton Hotels in New York and Atlantic City will be inaugurated in a few days. According to C. N. Reinhardt, who is in charge of the arrangements, passengers desiring to travel by air from New York to Atlantic City will have the choice of land and water routes. Five and ten passenger planes will be used. Eventually the regular service may be extended to Washington, Philadelphia and other cities. Bookings already have been made at the Ritz-Carlton here.

A year ago the rate for an air trip to Atlantic City was \$100, but the new rate probably will be about \$35. The machines will be chartered from established companies, including the American Airways Company, of which Mr. Reinhardt is a Director. This company, he says, has available ten five-passenger H-S-2-L planes of the navy bomber type, and soon will have ready six more machines, including two Curtiss flying boats of the two-passenger type. It is also planned to acquire a twelve-passenger flying boat from the American Transoceanic Company, and fast Leoning machines and probably some Fokker monoplanes. "The flying boats," said Mr. Reinhardt, "will start from Eighty-third Street and the Hudson River. If the Fokkers are employed, they will take on their passengers at Garden City, L. I. Passengers booked at the Ritz-Carlton Hotel will be transported by motor car to the points of departure, where they will be placed aboard the flight machines."

Mr. Reinhardt said that the reduction in the rate for air transportation had been made possible by the low price at which the Navy Department is selling its surplus stock of air machines. "The larger flying boats of the ten-passenger size, which cost the Government in the neighborhood of

\$30,000," he said, "can be bought for \$6,120. The two-passenger flying boats, which were acquired by the Government at prices up to \$13,000, can be obtained for as little as \$2,000.

"I have been informed that the attractive prices at which these flying machines are offered to the public by the Government have created a great demand for aeroplanes," he added, "and that more than a dozen individuals within the last three weeks have bought planes from the big stock awaiting disposal at the Philadelphia Navy Yard. Most of these machines are brand new."

St. Louis Club Banquet

The Flying Club of St. Louis held their Monthly Banquet at the Hotel Claridge, March 13, and a very pleasant evening was enjoyed by all those present.

About 250 members including friends and also a number of officers and enlisted men were present from Scott field. Several

short talks were made by the officers from Scott field, the Flying Club also renamed their flying field which was opened last December to be named Lambert field in honor of Major Lambert of St. Louis who has been a big figure in aviation for a number of years.

The club is starting a drive on for new members and it is the hope of the club to increase its membership by 100 per cent.

Moving pictures were shown of the Bombing tests that took place last June.

The Flying Club's new field at Bridgton, Mo., will be the scene of much flying this summer, and a number of interesting events will take place there.

Wichita Falls Meet

An aviation meet and carnival is being planned for Wichita Falls by the local American Legion Post, and will be held April 29-30. It is expected that thirty planes will participate. Government planes from Fort Sill will co-operate.

AERONAUTICS IN CONGRESS

The following memorandum concerning the progress of aeronautic matters in Congress has been prepared by the Aeronautical Chamber of Commerce.

Feb. 8. *Senate*—Mr. Jones of Washington introduces S. 3076, a bill to establish a bureau of Aeronautics in the Department of Commerce for the purpose of making it unfinished business.

Feb. 11. *Senate*—Appropriation for the National Advisory Committee for Aeronautics struck out of Executive and Independent executive bureau bill (H. R. 9981) by the Senate because of the pending bill S. 3076 to create a bureau of aeronautics in the Department of Commerce. Which brought up question of the need of the National Advisory Committee for Aeronautics.

Feb. 13. *Senate*—S. 3076, a bill to create a bureau of civil aviation in the Department of Commerce discussed in the Senate.

Feb. 14. *Senate*—S. 3076 passed the Senate 34 yeas and 16 nays.

Feb. 15. *House*—Message from the Senate that it had passed S. 3076 and wished concurrence of the House.

Feb. 20. *Senate*—Correspondence between Secretary Hoover and the Attorney General regarding trade associations inserted in the record.

Feb. 28. *House*—Mr. Hicks: a bill (H. R. 10617) to authorize the conversion of battle cruisers into aeroplane carriers; to the Committee on Naval Affairs.

March 1. *House*—Petition 4368. By Mr. Frothingham: Resolution passed by the Quincy (Mass) Chamber of Commerce, praying for the conversion of the cruiser Lexington to an aircraft carrier; to the Committee on Naval Affairs.

Petition 4380. Petition of the Commercial Aircraft Association of Southern California, Los Angeles, California, endorsing and urging support of the Hicks bill (H. R. 2815) a bill to create a bureau of civil aviation in the Department of Commerce; to the Committee on Interstate and Foreign Commerce.

March 3. *Senate*—Mr. Lodge presented petitions of 7,829 citizens of the city of Quincy, Mass., praying that the battle cruiser Lexington, now under construction at the Fore River yard be converted into one of the two aeroplane carriers authorized under the naval treaty, which were referred to the Committee on Naval Affairs.

House—Second Deficiency Appropriation Bill. An amendment to provide \$150,000 for helium experimentation and production cost.

Mr. Hicks: a bill (H. R. 10712) to authorize the conversion of battle cruisers into aeroplane carriers; to the Committee on Naval Affairs.

Mr. Kelly of Penn.: a bill (H. R. 10717) to encourage commercial aviation and authorizing the Postmaster General to construct planes for air mail service; to the Committee on Post Offices and Post Roads.

March 6. *House*—Mr. Hicks: a bill (H. R. 10742) to authorize the conversion of battle cruisers into aeroplane carriers; to the Committee on Naval Affairs.

March 9. *House*—Conference report on H. R. 998 (Independent Office Appropriations Bill) advises Senate to recede from its disagreement to Amendment No. 26. This amendment carried an appropriation of \$200,000 for the National Advisory Committee for Aeronautics and \$10,000 for the construction of an additional laboratory building. This amendment has been agreed to by the House.

March 14. *House*—In submitting the Army Appropriation Bill H. R. 10871 the Committee cut the Appropriation of the Air Service to about \$12,000,000. The Director of the Budget allowed \$15,000,000. Of the \$12,000,000, \$6,000,000 is allowed for the purchase of planes, \$400,000 for lighter than air and \$400,000 for helium experimentation and production.

Later in the discussion Mr. Fitzgerald in speaking on this bill urges the need of more money for experimentation.

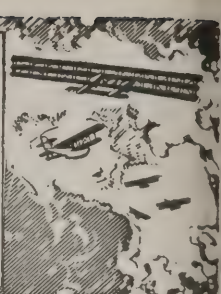
March 16. *Senate*—In discussing the Four Power Treaty, Mr. Reed introduces into the record the number of aircraft carriers of Great Britain, Japan and the United States with their speed, their armament and aircraft carrying capacity. United States has one; Great Britain 7; Japan 1.

March 17. *House*—A document by Rev. M. D. Shutter of Minneapolis on "The Army of the United States as a Constructive Force" was introduced into the record. In this document, he speaks of the extensive savings in timber by the use of the Forest Fire Patrol.

March 18. *Senate*—Appropriation of \$1,900,000 allotted for the air mail service by the Senate.



The AIRCRAFT TRADE REVIEW



Aerial Service Between San Francisco and Los Angeles Starts Daily Operation

With the delivery of two Aeromarine Navy HS flying boats to the Western Airway Company of San Francisco, began a new era in aerial transportation on the Pacific Coast. Announcement of this new aerial service was made today by C. F. Redden, President of the Aeromarine Engineering and Sales Company who have recently sold these two boats to the Western Airway Company.

A regular passenger and freight air service between San Francisco and Los Angeles is already in daily operation. One of these flying boats leaves San Francisco at 8:30 in the morning and another leaves Los Angeles at the same time. The fare for the total distance is \$50 per passenger.

O. L. Gagg, Pacific Coast Representative for the Aeromarine Company, stated recently that with the first of these Aeromarine Navy boats already in operation it would not be long before a large fleet of these same type boats would be winging their way between California cities.

With the opening of the flying season, sales of the Aeromarine Navy HS flying boats are becoming frequent. The Easter Airways, Inc., of Baltimore, Maryland, who recently purchased two additional Aeromarine Navy HS flying boats have started one of these boats on a long commercial flight under the direct charge of the President, Mr. P. E. Easter.

The first boat is now in Florida enroute to New Orleans.

"Wherever there is a large body of water in the United States, Aeromarine boats have flown," said Mr. Redden. "Their distinctive white wings and hull have become a familiar sight to thousands of people and are establishing in the minds of the general public the fact that aerial transportation properly conducted is absolutely safe. We are more than gratified to see the interest taken on the Pacific Coast in Aeromarine boats, and expect as rapid developments out there as we have seen in the East and Florida."

Loening in New Building

The Loening Aeronautical Engineering Corporation is now established in its new and specially equipped factory at Thirty-first Street and East River, New York City.

National Aircraft Underwriters Moves

The offices of the National Aircraft Underwriters' Association, formerly at 15 Park Row, New York City, are now at 120 West 42d St.

Hungesser Uses Farman

Capt. Nungesser, next to Fonk, the greatest of French Aces of the World War, with a total of over 70 official victories, has entered his order for a "Farman" two seater Touring Plane to be delivered to him on April 13th. Capt. Nungesser expects to make an aerial tour of Europe in the interests of commercial aviation.

Aeromarine News

New York, March 24, 1922—The disappearance and loss of a passenger carrying seaplane between Florida and Bimini is attributed to the lack of a Federal law enforcing the inspection of aircraft, according to Charles F. Redden, president of Aeromarine Airways, of New York and Key West, which to-day ordered to sea five flying boats and their surface aeroplane mother ship to aid in the search for the missing craft. Mr. Redden sent the following telegram to the Chairman of the House Committee on Interstate and Foreign Commerce, which has now before it the Wadsworth Bill, providing for the regulation of aerial traffic:

"The seaplane which is reported missing off the Florida coast, with five passengers aboard, has attracted wide comment illustrating the peril of flight. This seaplane does not belong to the Aeromarine Airways fleet and should not be identified with our operations between Key West and

Havana. Flying is just as safe to-day as travelling by rail, when rigid inspection of equipment is provided, either by private organization or by public authority. The fact that we have transported thousands of passengers from the mainland to Cuba without injury or loss of life, is explained by rigorous requirements and extensive facilities. These, however, are the exception in much of the general flying that is now going on. Aircraft four and five years old, never properly overhauled or maintained, operate over territory which, under conditions, invite disaster. When a mishap occurs, legitimate aviation gets the blame. Such accidents will multiply with increasing loss of life and to the consequent detriment to aerial transportation, unless Congress passes, without delay, the Wadsworth Bill providing for inspection of machines and licensing of pilots and establishing a Bureau of Commercial Aeronautics in the Department of Commerce."

LIFE INSURANCE AND AERONAUTICS

By R. R. BLYTHE

THE Commercial Aircraft Companies have in the past often brought up the question about the validity of the life insurance policies applying to the passengers in case of death caused by the participation in aerial flight.

A life insurance policy is a contract issued by a company or corporation to a person to indemnify the beneficiary or beneficiaries in case of death.

Since a life insurance policy is a life contract between the company and the assured, it is important that the company (and therefore directly or indirectly the policy-holders) know whether the applicant is engaged in an occupation or profession which is extra hazardous or whether the physical conditions of the applicant are normal, in order that the ordinary span of life may be expected.

If this information is correctly given and accepted by the company, in most cases the policy is incontestable for any cause whatsoever after having been in force one or two years, depending on the company; with the exception of the fraternal orders, who do not have any uniform rules in this connection. To quote the actual wording from one of these life insurance contracts, it states that "there are no restrictions under this policy while in full force of travel, residence, occupation or military or naval service." This would also include aeroplane flights as passenger or otherwise.

In the New York Times, Sunday, March 26, the following item appeared: "The Larabee Flour Mills Corporation will collect \$200,000 as the result of the death of August Bulte, who perished in the seaplane Miss Miami."

Three officials of the same corporation in November, 1919, applied for life insurance of \$600,000, the policies payable to the corporation. The applications for in-

surance of \$200,000 each were from Frank Larabee, Fred D. Larabee and August Bulte. Policies were issued to Mr. Bulte and Fred Larabee, but the application of Frank Larabee was held up.

The next March Fred Larabee died and his company was paid \$200,000. He had paid one premium.

Frank Larabee reapplied for insurance in September, 1920, and obtained a \$100,000 policy. He died in June, 1921, after paying one premium, and \$100,000 was paid to his company.

The policy issued on the life of August Bulte in November, 1919, has drawn three premiums to date. Through corporation insurance of its officials the Larabee mills will have collected one-half million dollars in two years. The total premiums paid was about \$17,000.

It is usual in most life insurance companies to issue what is known as a "double indemnity" coverage at the approximate rate of \$1.00 extra premium for each \$1,000 in the amount of the policy. This double indemnity stipulates that in case of accidental death of the person therein insured double the amount of the policy shall be paid to the beneficiary or beneficiaries.

There is a clause in reference to this article which reads somewhat as follows: "The double indemnity feature of this policy does not cover during military or naval service of any kind in time of war or by engaging as a passenger or otherwise in submarine or aeronautic expedition."

It may be, therefore, stated that in most cases where life insurance has been issued without question and is in force one or two years, as per stipulated incontestable period in the contract, that any claim arising from death suffered from participating in aeronautics is not contestable by the life insurance companies.

THE PROGRESS OF RESEARCH

By Brig. Gen. R. K. BAGNALL-WILD, C. M. G., C. B. E., F. R. A. E. S.

Director of Research in the British Air Ministry

(Concluded from page 79).

Navigation

The most difficult of all problems in connection with "Navigation" is the provision of means in foggy or misty weather to enable an aircraft to locate the aerodrome for which it is bound and to make a successful landing to it. Unquestionably it is this difficulty which causes pilots on long routes to prefer to fly under, rather than over, clouds. Professor Jones, in a paper read not long since before the Royal Aeronautical Society, gave many reasons why it would be better for such flights to be made above the cloud layer, but ample experience before then and since has shown that it is no use to expect pilots to do this until their minds are reassured as to the adequacy and reliability of the ground organization enabling them to make safe landings through fog.

As one of the Committees of the main Aeronautical Research Committee, Professor Lindermann suggested that the best means of landing in a fog might well prove to be the provision by the aerodrome so afflicted of two pairs of small kite balloons floating above the cloud layer, the first pair being at such an altitude as would enable a gliding machine, which passed between them, also to glide between the second, and lower, pair, and after an equal interval of time to land on the aerodrome.

In the case of thin fogs or ordinary mists it may be that the specially bright red ground-flares which are now being tried will suffice. In heavy fogs there is always the possibility, given the right ground organization, of detecting the position of an aeroplane by sound and of signalling to it by wireless when to glide down and in what direction. This has been done successfully at Croydon.

Suggestions have been made to get rid of the fog either by mechanical means of pumping, or alternatively by electrical discharges, or even by burning vast quantities of coal or other fuel in order to warm the air above the saturation point; these three methods could easily be tried on a small scale and would doubtless work; when, however, they are figured out for an aerodrome of normal size the cost of their introduction is found to be prohibitive.

When in 1912 use was made of the precessional movement of a gyrostat to measure the velocity of roll on one of His Majesty's ships, it was not contemplated that by far the most successful application of the apparatus would prove to be for air travel; it is known as the gyro turning indicator, and ample experience has shown that it is more sensitive and much more rapid in its indications than any other method that has been tried for indicating the turns of an aeroplane. Unlike the use of a constant azimuth gyro, this apparatus does not need to be delicately balanced as regards the position of its center of gravity, and is therefore remarkably fool-proof. Aeroplanes flying in a fog frequently get into turns without knowing it, and when they do so, the magnetic compass, particularly when of an old pattern, is pretty sure to indicate a turn in the wrong direction, and so thoroughly mislead the pilot.

Modern compasses are much less affected than were their predecessors by the yawing oscillations of an aeroplane or even by moderately rapid turns off North, and this is due in the first instance to the work of Keith Lucas and Lindemann when at the Royal Aircraft Establishment, and later by the work of Dr. Bennett of Emmanuel College, Cambridge, and the late Lieut.-Commander Colin Campbell of the Admiralty Compass Observatory. The Farnborough work showed the advantage gained by a long period, whilst the later inventors pointed out the great advantage of damping the oscillations of the magnetic needles even to the point of aperiodicity.

It is a natural speculation as to what is likely to be the amount of deviation error in the magnetic compass when machines are built entirely of steel. Such tests as have already been made are, however, reassuring in this respect. It seems that the deviation error in any machine is largely dependent on the proximity of the engine, and that this effect predominates whether the framework is constructed of wood or of steel.

As regards navigation, either when flying over the sea out of sight of land, or when flying at any time above clouds, the necessary instruments to enable the position to be determined by the methods of nautical astronomy are now available. They have become sufficiently developed to enable the position to be obtained with a probable error not over ten miles. This is as high a standard of accuracy as is necessary for ordinary air work: it enables a check to be made on the Dead Reckoning

course, and upon any determinations of positions derived from wireless methods.

The study of Directional Wireless is being steadily pressed forward. A particularly promising form of it is the rotating wireless beacon; this method offers the very considerable bait of freedom from the troublesome quadrantal error, but it, like other wireless methods, depends for its ultimate accuracy on a careful study of the conditions which determine the nature of the path followed by the waves.

Machines

The question of stability is being continuously studied, and I hope in the future that it will prove possible so to organize the work as to give more time to this important subject. If possible, one of the National Physical Laboratory wind channels should be allocated entirely to this work.

Stability may be either inherent or automatic. Automatic stability is attained through the operation of some more or less complicated auxiliary mechanism, whilst inherent stability is stability due directly to the nature of the design of the aerodynamic surfaces, the disposition of weights, etc. If inherent stability can be attained there will be small need for automatic stability. At present the problem of longitudinal stability is to a large extent solved, but that of lateral stability still requires a great deal of work to be done upon it. Much has also to be done on the measurement of pressure distribution over wing surfaces; I hope that in the future it will be possible to give more time to this subject.

Not a little public attention has been drawn to the interesting arrangement of slotted wings proposed by Mr. Handley Page. A large Handley Page monoplane wing with a single long slot is now at Farnborough awaiting test. This wing also has short slots in front of each aileron. Two other new Handley Page designs are also in hand. The results will be followed with great interest. The earlier trials have shown very remarkable results. A D.H.9 aeroplane, fitted with a Puma engine, was found when equipped with a Handley Page wing to have both greater aerodynamic efficiency and greater climbing capacity than when fitted with the standard wing. The climbing slope in the one case was 1 in 7.2, and in the other 1 in 10.4. This is an important consideration when clearing obstacles around an aerodrome. Moreover, for getting off and on to decks, it was found that the launching run with the Handley Page wing was less than half that necessary with the standard wing under similar conditions. Public attention has also been drawn to the "Alula" wing, and careful tests have been made of models in the wind channel; these have not so far demonstrated that a wing made in this fashion should be exceptionally good, but it is conceivable that the scale effect between a model and a full size may be unusual in a wing of this shape. The point is being looked into.

As regards propellers there is no doubt, as has been pointed out by my predecessor, that a complete metal propeller would be a great boon. I would even go so far as to say that for all Service aeroplanes in the East they are essential, even at the cost of a greater propeller weight. For sizes of over 450 hp. there is reason to hope that the increase in weight will not exceed 10 per cent.

Now that the supercharging of aero engines has been shown to be a possibility, it is necessary, in order to take full advantage of it, to provide a variable pitch propeller; these will also almost certainly have to be of metal. Work is therefore in hand in this direction at Farnborough, and I trust that it will be found possible to do all that is necessary without a disadvantageous increase in weight or complexity.

The ability to fly off or land on the deck of a ship is becoming increasingly necessary. Development work to this end is in hand, and I hope the future will show that amphibians as well as aeroplanes will be easily capable of being used for this purpose. It is very necessary that they should, since descents onto water cannot always be avoided, and "landings" of this kind with aeroplanes are liable to be expensive. Experiments are in hand to examine into the sea-keeping abilities of the large N.4 flying boats. These weigh some 30,000 lbs. and have engines giving a total of 2,600 hp. It is hoped they will prove themselves good sea going craft.

And what of the helicopter? It is difficult to know what to say. Efforts are proceeding and public money is being spent; we shall, I hope, be rewarded for our foresight. Mr. Brennan's helicopter has flown to the extent of lifting the

pilot and 250 lbs. useful load—an encouraging preliminary flight.

Much public attention has been drawn to the tests made this winter on different types of fuel tank proposed by various designers. As is generally known these tests were made by inflicting on the tanks submitted a destruction experiment analogous to that of a heavy crash.

The difficulties in regard to the construction of fuel tanks were brought home during the War. It was soon found that the use of a suitable rubber envelope would prevent petrol from leaking from a small bullet hole, but the problem to be solved was a much more difficult one than this. If an empty fuel tank were fired at, a small hole would be made in the metal wall at entry and another at exit. If this, however, were done with a full tank the size of the hole at entry would not be changed, but the exit hole would be enormously increased in size, sometimes amounting to the blowing out of the far side of the tank. The latter effect was no doubt due to impulsive pressure in the liquid, but the right steps to take in order to minimize its effect were not so easily apparent. As is now generally known something very close to a solution was found in the introduction of a very thin walled tank coated on the outside with rubber and known as the Imber tank; it was, however, somewhat heavy, and was not considered to be entirely satisfactory as a fuel container under the conditions of a crash. When a tank full of petrol crashes there is initiated in the mass of the liquid an intense impulsive pressure not very dissimilar to that which is created when a high velocity projectile is suddenly brought to rest in the first few inches of the penetration of the liquid mass. To test the Imber tank, two Sopwith Camel aeroplanes were fitted with main and gravity tanks of this pattern and dropped, with engines going, from Airship R.33. The intent was to stimulate a spinning nose-dive crash with engines running and all possible causes of fire on impact free to operate. In the first test the main tank was burst by the impulsive pressure and a mad spray of petrol hot up; the gravity tank did not suffer so badly. In the second test the engine did not open out fully and the crash was less severe; both tanks survived and there was no spray or leakage of petrol. In neither case was there a fire.

Materials

The work of the Materials Sub-Committee of the Aeronautical Research Committee has led to the undertaking of researches of very great importance, not only for the future of aircraft construction, but for the engineering industry generally. On the latter, however, this is not the place to dilate. The special need in aircraft construction which differs from previous engineering experience is the enforced weight limit. The long confirmed custom of measuring the tensile strength of a material and then dividing this by some "factor of safety" of 5, 6 or 7 is inapplicable to aircraft since the resulting structure would be far too massive. In aircraft, perforce, finer limits have to be worked to and this renders it essential that the logical basis of design should be closely examined. The result of this scrutiny is to show the need to think rather of fatigue limits than of ultimate stress limits. The great difference between these two methods is seen in the effect of a tool

mark or scratch on say a crank-shaft. Under a steady stress, local yielding would quickly absorb the minute area of high stress, but under an alternating stress the sensitive area is pulled to and fro until an appreciable portion of the shaft is weakened, and breakage results. A study of these matters is bringing forward new methods of testing, and it has, moreover, thrown light on that "scientific puzzle," the spiral fracture of a shaft. Work at Farnborough has shown the ideal limits for tensile strength and with certain substances this limit has, temporarily, been very nearly attained. I need not dilate on the immense importance of these possibilities to all engineering work, and to that of aircraft especially.

Tests on the fatigue of the materials used on aircraft are being carried out at more than one center. Investigations on this, or allied subjects, are being undertaken at the Universities at Leeds, Edinburgh, Bristol and Birmingham, in addition to researches at the National Physical Laboratory and elsewhere.

Perhaps the most troublesome material in present-day aircraft is the rubber tubing used for conveying petrol. It has to be of the "P.R." or "petrol resisting" quality, and it seems unfortunately to be the case that the effective life of this rubber is but six months, so that by the time it has been shipped to a distant Air Force center and been passed into store for a moderate time, a large proportion of its effective life—and sometimes the whole of it—has vanished. To avoid this serious difficulty the Royal Aircraft Establishment has fitted machines with piping of copper; but it is unfortunately much more difficult to fit stiff pipes than flexible ones. Happily, however, the "petroflex" piping devised by Mr. Blaisdell affords a very useful means of avoiding both the rapid aging of the rubber and the stiffness of the copper. Petroflex is rather a wonderful material. It is made up of some ten layers, glued together, of the intestines of Chinese hogs, of which, fortunately, there seem to be illimitable numbers. Around these are layers of canvas, fire-proofed. Outside this in turn, as a final protection, is a spiral of metal wire (aluminium in the case of land machines). This tubing appears to be totally unaffected by petrol, though care has to be taken to keep water away from its inside. Experiments have shown that the piping will stand as much as 200 lb. per square inch of internal pressure. Fifty sets have been sent out to the East for trial.

A supply of the right quality of timber for building aircraft is one of the most serious responsibilities to those in charge of such matters. It has been of especial importance in the last few years owing to the world demand for timber of all kinds, and the consequent indisposition of markets to take great trouble in sorting the timber or in drying it. This bears particularly hard on aeroplane construction, and I am therefore very glad to find that Canada is no supplying spruce so carefully selected that it seems not unlikely that over eighty per cent will be found to comply with our best quality specifications. There are therefore great possibilities in this direction.

An interesting development is the introduction of non-magnetic steels for those parts of aircraft which are in the immediate neighborhood of magnetic compasses. The use of stainless steel or stainless iron has also many possible applications.

Sixth Corps Aero Plans

Plans for class room instruction for officers desiring to take the examinations for promotion in the Reserve Corps were laid March 25 at a meeting of the Air Service Officers' Association of the Sixth Corps Area. The meeting was held in the Army and Navy Club, Chicago. Major William C. McChord, Air Officer of the Sixth Corps Area, and Lt.-Col. Morris N. Keck, engaged in the organization of the reserves in this area, gave short talks on what had already been accomplished in the way of organization and the plans for the future.

According to these officers, the fundamental basis for promotion in the reserves will be that of inherent ability, rather than promotion on the basis of seniority, as in the regular army, where, it was added, conditions were somewhat different and that promotion by seniority seemed to be the most practical method.

"I do not anticipate that the technical and general examinations which candidates for promotion will be called upon to pass will be very severe," said Major McChord. "Great weight, however, will probably be given to the candidate's demonstrated ability in civil life, his past record in the service and the extent of his present interest in the work of the organized reserves. All these things will be taken into consideration in connection with the examining board's estimate of his value to the reserves in the particular rank and branch of the service for which he is taking the examination. There are many vacancies in the grades of 1st lieutenants, captains, and higher grades which must ultimately be filled, and we are bending every effort to pick men competent to fill them. It is a painstaking and difficult task. Let me repeat that, other qualifications being equal in considering candidates for vacancies, evidence of continued and sus-

tained interest in the difficult period that the reserve is now going through will undoubtedly carry weight with the examining boards."

First Lieut. Kenneth T. Price of the reserves gave a résumé of the probable line of question in the examination on Military Law. His talk will be followed from time to time by other members of the reserve, leading discussions of other subjects the examinations are scheduled to cover. Capt. P. G. Kemp, A. S. O. R. C., chairman of the association, presided at the meeting. Other reserve officers present were: Lts. Joseph P. Dunne, Homer S. Watt, Herman H. Woeltjen, William E. Bausch, Arthur H. Stanton, J. W. Schroeder, Henry T. Hemmingway, E. G. Tuttle, R. E. Ailsworth, Leo L. Leonard, C. G. Geisler, S. J. Bovey, Raymond R. Rehm, Keith Jones, Otto Grafe, Roger F. Howe, J. C. Keogh, R. C. Kuhn, M. D. Harbula and Dallas M. Speer.

THE THEORY OF THE SCREW PROPELLER*

By A. BETZ, GÖTTINGEN

THE reason why the comprehension of what occurs in the vicinity of a propeller is commonly regarded as especially difficult, does not lie so much in the complexity of the hydrodynamical phenomena as in our limited ability of geometrical presentation, which some times fails us, even in simple cases, when these have a spiral form. The mathematical treatment is rendered still more difficult by problems connected with the propeller symmetry. Aside from the above inconveniences, which are not inherent in the nature of the phenomena, the propeller offers no greater difficulties than the majority of other hydrodynamic problems. By confining ourselves to the most essential phenomena, we can represent them in a very simple fashion. It is characteristic of this simplicity that we have long had a presentation of the theory of the propeller in Rankine's propeller slip-stream theory, which is a fairly close approximation to the truth and which may be regarded as a sort of forerunner of the modern theory† of aerofoils. Only when we endeavor to acquire a more accurate knowledge of the phenomena, will the theoretical treatment become more difficult. Our knowledge is most deficient in regard to the mutual action of propeller and airplane. In this connection, we must depend almost entirely on experiments. The cause of this ignorance resides less, however, in the propeller than in the resistance of the aeroplane, which here plays a very important role. This problem of the resistance of a body moving in a fluid and the attendant loss of energy, aside from any special cases, has thus far withstood all theoretical treatment and has had to be worked out almost exclusively by means of experiments. It is therefore natural that our imperfect knowledge of the phenomena which determine the resistance of the aircraft also hinders the theoretical treatment of the related propeller phenomena. The problems relating to the independent operation of the propeller are, on the contrary, with the exception of a few very special problems, mostly solved, at least as regards propellers with favorable shapes, which alone are of any practical importance. This limitation has the advantage of enabling us to assume as small the loss of energy from friction and the formation of vortices, over which we have the least control, as compared with the amount of energy otherwise lost, and the further special advantage that the large number of shapes which otherwise would have to be considered is thereby greatly reduced. The following exposition will consist of a brief review first of the fundamental development through later researches, which demonstrate the connection between the propeller slip-stream theory and Froude's so-called "propeller blade theory."‡

If we wish to exert a force on a body, for example, on a vehicle to overcome the head resistance, we must use some other body as a brace and exert upon it the same force, but in the opposite direction (law of action and reaction). In a moving vehicle on the solid earth, the latter is nearly always the resisting body, which, on account of its large mass, suffers no noticeable change in speed from the reaction. The case is different, if we utilize a relatively small body which is not rigidly connected with the earth. In such a case, the body is affected by the force of reaction and acquires a noticeable velocity. This phenomenon is very apparent in firing a cannon ball. We wish to impart a velocity to the ball and therefore a force must be exerted upon it. The cannon is the resisting body and is given a velocity in the opposite direction to that of the cannon ball (recoil). The case is similar if we wish to set in motion a body in a fluid (air or water) by means of a propeller. We may think of the process as follows: A mass m of the fluid is utilized for a second as the reacting body and acquires a certain velocity v . Then another equal mass of fluid is brought into play and serves as the reacting body for the next second, etc., so that in each second a mass m acquires an increase in velocity v . If S represents the propeller thrust, the force of reaction must have the same value and the acceleration a , imparted to the mass m in one second by the action of this force, is $a = S/m$.

It is not essential for us to think of the process as being divided into intervals of one second. If we represent each interval by $1/n$ th of a second and take the corresponding

$1/n$ th part of the mass, we obtain for the same reaction force, the same velocity and the mass accelerated *per second* remains the same. The velocity imparted to the reacting fluid is directly proportional to the thrust and inversely proportional to the mass of fluid acted upon per second. With this velocity, the fluid acquires an increase in energy amounting to $\frac{1}{2}mv^2$ per second. This energy must be supplied in addition to the useful power in order to obtain the desired thrust. It means, however, an unavoidable loss of energy.

If all other losses are disregarded, it follows from an extension of the above reasoning that the most favorable case is when the thrust is evenly distributed over the whole surface of the propeller blades. This condition would be approximately fulfilled by a propeller with very many blades. The theorems for the losses in the propeller slip stream obtained from this very simple theory are very useful for estimation of the efficiency of a propeller, since the remaining losses are ordinarily considerably smaller and not so dependent on external conditions.

The theory also gives the velocity with which the fluid passes through the plane of the propeller. It may be shown that the fluid passing through the propeller acquires half its acceleration in front of the propeller and the other half behind it. An accurate knowledge of the flow at the plane of the propeller is however much desired, since it will give us a basis for calculating the blades and the position to be given them in order to obtain the desired thrust. For this purpose, however, the results of this primitive theory are no longer entirely adequate. So long as but little was known concerning the action of the fluid on the propeller blade, there was no great need of a more accurate knowledge of the flow in the plane of the propeller. But after the investigation of the phenomena of aerofoils had laid in this respect the foundation for a more accurate calculation of the propeller blade, it was also desirable to increase the knowledge of the flow in the vicinity of the propeller.

There were in the main two points requiring further elucidation. In the first place, the propeller, in addition to the motion of the slip stream parallel to its axis associated with the thrust, also generates tangential motions which necessitate a slight correction to the considerations of energy and, what is more important, produce a noticeable increase in the flow through the propeller disk. In the second place, screw propellers always have had a very limited number of blades. It was therefore desirable to determine what difference this circumstance makes in comparison with the assumption of a large number of uniformly distributed narrow blades. In both directions considerable progress has recently been made. Although some points have not yet been worked out for convenient practical application, the principal difficulties have nevertheless been overcome.

The investigation of the rotation of the propeller slip stream is closely connected with the above-mentioned considerations of the simple older theory. Simply, the propeller torque is substituted for the thrust. The connection between the individual quantities is indeed considerably more complex in this extended propeller slip-stream theory than in the older theory, and the calculations are more difficult. But after the requisite laborious calculations have once been made, the results can be expressed in the form of curves, which can serve as the basis for practical applications.*

The second point, in which the old propeller slip-stream theory needed to be supplemented, was the assumption that the thrust could be distributed at will over the surface of the propeller disk, which holds true to a certain degree for a propeller with very many narrow blades, but certainly not for an aeroplane propeller with two blades which cover only a very small portion of the propeller disk. It may however be here noted that the difference in comparison with the uniform distribution is not so great as appears at the first glance. On account of the revolution of the propeller, its blades exert a pressure at every point of the propeller disk, only not simultaneously and continuously, but periodically, always again at another place.

For the treatment of this propeller with widely separated blades, there is a very useful method which was developed principally in connection with the theory of aerofoils and has already been very successfully applied in that connection (Compare the article, Betz, "Einführung in die Theorie der Flugzeug-Tragflügel," Die Naturwissenschaften, Vol. 6, p. 557). A field of well-defined vortices is connected with the distribu-

* Reprint from "Die Naturwissenschaften," 1921, No. 18.

† Rankine, "On the Mechanical Principles of the Action of Propellers," Transactions of the Institution of Naval Architects, 1865, Vol. VI, p. 13. The theory was considerably improved later, especially by Froude, Froude, "On the Part Played in Propulsion by Differences of Fluid Pressure," Transactions of the Institution of Naval Architects, 1889, Vol. XXX, p. 390.

‡ Froude, "On the Elementary Relation between Pitch, Slip and Propulsive Efficiency," Transactions of the Institution of Naval Architects, 1878, Vol. XIX, p. 47.

* Betz, Eine Erweiterung der Schraubenstrahltheorie, Zeitschrift für Flugtechnik und Motorluftschiffahrt, 1920, Vol. CI, p. 105.

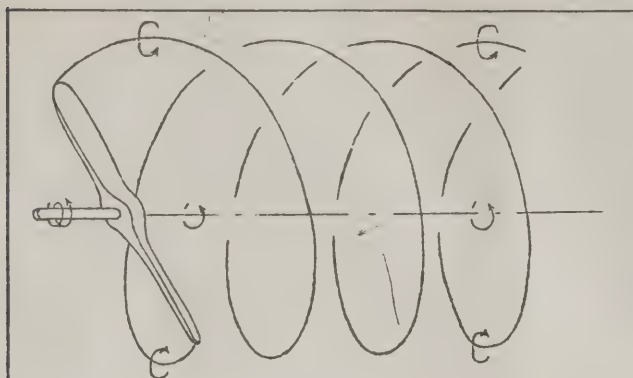


Fig. 1 - The system of the most important vortices behind a screw propeller.

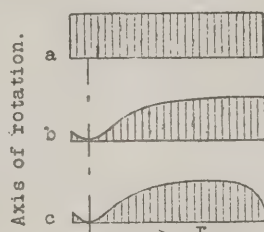


Fig. 2 - Most favorable thrust distribution over the propeller disk:

- a) according to the simple propeller slip-stream theory;
- b) considering rotation of slip-stream;
- c) considering finite number of propeller blades.

tion of the propeller thrust, or the lift of a wing. Since, on the other hand, the motion of the fluid is definitely determined by the vortices existing in it, we can calculate the flow from the thrust distribution by means of this concept of vortices.

Such a calculation, however, consumes considerable time. An effort has been made, therefore to simplify this work. Föttinger gave a practically applicable method in his lecture before the Society of Naval Engineers (Schiffbautechnische Gesellschaft) in 1917.* He proceeded from the correct concept that the strongest vortices are restricted to definite regions, so that we can represent them approximately by single vortex lines. These lines are the propeller axis and the spiral lines going out from the tips of the propeller blades and encircling the propeller axis (Fig. 1).

As in the theory of aerofoils, in which a corresponding approximation is employed, this simple vortex picture always performs very good service, when the flow is investigated at some distance from the vortex lines. That the picture of the flow in the vicinity of the individual vortex lines can no longer agree with reality follows from the fact that the theoretical velocity in the immediate neighborhood of an indefinitely thin vortex line is infinitely large. If we wish to investigate the flow in the vicinity of the vortex field, more especially, for example, at the place where the blade itself is, we must have as a basis more accurate data on the distribution of the vortices, that is, on the distribution of the thrust along the blade.

After it had been demonstrated by the theory of aerofoils (in which the same difficulties occur, though to a lesser degree) that the most favorable lift distribution gave very simple flow relations, the idea suggested itself to investigate as to whether, for the propeller also, the most favorable thrust distribution is not characterized by very simple flow relations. As a matter of fact, perfectly analogous laws for the propeller can be derived by proper modifications of those employed for aerofoils.†

The most important one of these laws reads: The flow behind a propeller which has the least loss of energy agrees with the ideal flow about rigid screw surfaces displaced axially backwards. The shape of these screw surfaces is that which is cut in the fluid by the propeller blades in their motion. The speed of the displacement depends on the magnitude of the thrust.

* Föttinger, Neue Grundlagen für die theoretische und experimentelle Behandlung des Propellerproblems. Jahrbuch der Schiffbautechnischen Gesellschaft, 1918, Vol. 19, p. 385.

† A. Betz, Schraubenpropeller mit geringstem Energieverlust, with an appendix by L. Prandtl, Nachrichten der Gesellschaft der Wissenschaften zu Göttingen, Math. physik. Kl. 1919, p. 193.

However simple this statement concerning the flow generated by a propeller with the most favorable thrust distribution may appear, the problem is nevertheless not entirely solved by it. The mathematical treatment of the flow about such a displaced screw-surface presents very great difficulties. Prandtl has given an approximate solution of this problem in an appendix to the writer's article mentioned in the footnote. Though this solution does not give entirely accurate values, especially for the two-bladed propeller, it is perfectly satisfactory however for practical purposes.

Fig. 2 represents the most favorable thrust distribution, as determined by the old propeller slip-stream theory and also by the later improvements of the same. The thrust per unit surface is represented for the different distances r from the axis of the propeller. In case c, the thrust, which is here concentrated on the blade, is to be thought of as uniformly distributed on the circumferences belonging to the corresponding radii. In the old propeller slip-stream theory, the thrust is evenly distributed over the whole surface. With the consideration of the slip-stream rotation, we obtain a pressure drop at the axis and, with the consideration of the finite number of blades, we obtain also a pressure drop at the blade tips.

In deducing the laws of the screw propeller with the most favorable thrust distribution in the case of a finite number of blades, it has been assumed that the thrust is so small that the flow velocities generated by the propeller can be regarded as small in comparison with the proper motion of the propeller. We can, however, by foregoing strict mathematical accuracy, but without any error worth mentioning, so modify the laws that they will also hold good for more heavily loaded propellers.

In all the preceding discussion it has been taken for granted that we possess in the propeller blades a suitable device for exerting forces on the air, which will produce the desired thrust. No knowledge has been gained however as to the necessary shape of the blades for obtaining the desired effect nor as to the loss of energy due to the production of pressure by the blades. These data may be supplied by a method entirely different from the preceding. Its principles were expounded by Froude in 1877. Both theories, the propeller slip-stream theory and the propeller blade theory, long existed side by side, without our being able to give an entirely satisfactory explanation of the real connection between them. Knowledge of the phenomena in the vicinity of aerofoils, and more especially of the influence of the span on the resistance, first shed light on the corresponding phenomena in the vicinity of propellers.

If we assume that the effects of the individual parts of the blade, in its motion through the field, are independent of each other, we only need to determine experimentally, once for all, the forces arising in connection with the motion of definite cross sections, in order to calculate from them the forces acting at every point of the blade. The magnitude and direction of the velocity of the particular portion of the blade is indeed given by the two components, the circumferential and the forward motion. From the forces acting on the individual portions of the blade, the thrust and torque of the whole propeller can then be readily calculated. In practice, this method has the important advantage of giving the relation between the thrust and the torque, on the one hand, and the shape of the blade, on the other. Unfortunately, the assumption that the individual parts of the blade do not interfere with each other in their effect is not correct. In practice, we may, to a certain extent, avoid this difficulty by taking as the basis of the calculation for each propeller type somewhat different section characteristics, so selected that the resulting values for the whole propeller agree with the experimental values.

The propeller slip-stream theory, especially in its improved form, now gives us the basis for determining the mutual influence of the parts of the blade, so that, in calculating the shape of the blade, we can go along with certain section characteristics, which have been determined once for all. As we have already seen, the fluid has acquired a certain added velocity in passing through the propeller disk. Consequently the motion of the blade section relative to the fluid is dependent not only of the forward and circumferential speed, but also on this proper velocity of the fluid. In this acquired velocity, expression is, however, found for the whole influence exerted by the remaining parts of the propeller or the effect of an individual section. The connection between the acquired velocity and the section characteristics is especially manifest if we compare the loss of energy, as given by the propeller slip-stream theory with the loss appearing at the blade in consequence of this added velocity. When we thus combine the propeller slip-stream and propeller-blade theories, we obtain a complete theory, corresponding well with facts of the screw propeller operated by itself. The propeller slip-stream theory gives the action of an ideal propeller which, among other things forms the basis for the correct application of the propeller-blade theory. The latter clears up the additional phenomena which depend on the special properties of the blades and more especially the magnitude of the losses at the propeller blade, not considered in the propeller slip-stream theory.

It is intended to show, by the above explanations, that the new theories present the possibility of investigating the phenomena in the vicinity of a propeller, so as to be able to calculate its action on the basis of fewer experimental values. As already mentioned, there is still much work to be done in reducing the methods to a convenient form for practical application. There is also much still to be investigated experimentally. Aside from all questions concerning the mutual effect of propeller and aeroplane, there are the characteristics of the blade sections, which still require thorough investigation. Although we have very accurate values for aeroplane wings, it is still uncertain whether these values can in all cases be applied in their present form to propellers. The centrifugal force of the revolving propeller may well cause deviations. Furthermore, at high velocities, the compressibility of air as likewise the so-called cavitation in water, plays a certain role. There is still, therefore, in spite of all theoretical progress, a rich field for experimental activity in connection with the screw propeller.

(Translated by the National Advisory Committee for Aeronautics.)

COMMERCIAL AVIATION DEVELOPMENTS IN EUROPE

By W. KNIGHT, M. E.

(Continued from page 3)

ITALY

In Italy, unlike the other countries we have discussed so far, the Government has taken a surprisingly limited interest in the development of civil aviation, whereas after the war, in other countries, the Governments have done all that was possible in order to encourage the establishment of aerial lines and in keeping alive the aircraft manufacturing industry. In Italy, due to either or both the lack of funds in the budget to devote to aeronautics and the lack of a well defined program in aeronautics, we find that since the war the burden of keeping alive aeronautics in Italy has been thrown entirely on the shoulders of aircraft manufacturers. Under the circumstances, it is rather remarkable what has been done by them in the last two and one-half years, with practically no orders from the Government and thrown on their own resources for finding markets for their products.

Aircraft manufacturers in Italy have been devoting all their efforts since the war in creating a demand for Italian aircraft abroad, and the few good firms that are still in existence find that their efforts are meeting with a good success.

The skill of the Italian workers, the ability of Italian aeronautical engineers, which is of a high order of excellence, and the comparatively low cost of labor in Italy, due to the exchange situation, makes it easy for Italian aircraft manufacturers to sell their products abroad and to keep from disbanding at least the nucleus of their manufacturing and designing organization, which during the war was composed of almost 500,000 men.

The most important firms which are still in the market as aircraft manufacturers are: the Ansaldo, the Caproni, the Breda, the Fiat, the Macchi and the Savoia. The last two being particularly specialized in the design and construction of seaplanes and hydroplanes, which can compete with similar construction made by other nations, some of their types being distinctly superior to corresponding types built by other nations. These two firms are doing very good export business and are supplying hydroplanes to foreign navies besides the Italian Navy. The Ansaldo Company has built a number of aeroplanes for passenger service of a very good design and well adapted for such service. The Fiat Company has built the best wooden aeroplane for commercial purposes, which has been flown so far. This machine was designed and constructed by Rosateli, (one of the most genial aircraft designers), for making the flight across the Atlantic, which, however, was never attempted. The Fiat Company has also designed two aeroplanes, one for six and the other for ten passengers and a three unit power plant with a single propeller. The Caproni firm has built last year, a Giant aeroplane for 100 passengers, which, however, during the trial test, was partially smashed up and is now being reconstructed.

Italy has always been very active in dirigible construction. The Italian dirigible (of which we have recently acquired a unit, the "Roma," now destroyed) is the semi-rigid type. Dirigibles of this type have been made at the "Royal Aircraft Establishment" in Rome, operated by the Italian Government directly, and dirigibles and balloons both for the Italian Government and foreign Governments have been made here. There is now under consideration by the Italian Government, a project for selling the "Royal Aircraft Establishment" to a civilian syndicate and let the syndicate take care of the construction of Italian dirigibles. It is anticipated that such a move, if the proposed project is approved, will give a more healthy life to the dirigible industry in Italy.

A number of aerial navigation companies have been started in Italy, but none of them has established and operated a regular service on some definite route. The activities of these companies have been mainly limited to advertising flying as a new means of transportation and to make flights with passengers upon request. Among the most active of the various companies, the S. A. I. A. M., during its first year of operation from June first, 1920, to May 31, 1921, made the following record:

	Hours of Flight	Passengers Carried
June 1920	96.45	365
July "	101.35	591
Aug. "	160.12	453
Sept. "	173.30	520
Oct. "	125.45	374
Nov. "	110.13	215
Dec. "		
Jan. 1921		
Feb. "	90.11	238
Mar. "	37.50	139
Apr. "	45.30	217
May "	56.40	240
Totals	998.11	3352

Another company, the S. A. C. T. A., is going to open up, next summer, the line between Genova-Porto Torres and Porto Torres-Cagliari, between the mainland and the Island of Sardegna.

A regular aerial service has been organized and it is operated by the Government in one of the Italian colonies in Africa between Tripoli and Hons, making one trip per week for carrying mail. The passenger service is limited only to Government officials and Government employees travelling in the service of the Government. The passenger service is effected with 450 H. P. Caproni machines and the mail service is effected with S. V. A. machines. This is only a short line, only 62 miles long, and a very small attempt to establish aerial mail service in Lybie.

No aerial mail service is in operation in Italy at the present time.

Contrary to what the French Government is doing in establishing hydroplane bases in the Mediterranean, very little is done in Italy in this direction, in spite of the fact that the geographical location of Italy in the middle of the Mediterranean, would make it extremely expedient to develop and to maintain a large number of hydroplane bases. The hydroplane port service is operated by the Italian Navy only. Only in Naples, Taranto and Brindisi, the service is well organized. In the hydroplane ports of Venice and San-Nicolas-Varano, the service is only partly organized. In the hydroplane ports of Livorno, Orbetello, Ostia, Syracuse, etc., the service is very poorly organized, lacking as they are in sufficient fuel and oil reservoirs and spare parts. What has been done very efficiently by the Government has been the organization of a very good aerological service for supplying aerial navigators with all the required data. The technical services are well organized and have a very good personnel, working at technical investigation and research work, but they are always struggling along with insufficient funds to carry on their work.

The Italian Admiralty has undertaken the installation of lights on the airdomes of San Remo, Spezia, Orbetello, Centocelle, Naples, Trapani, Catania, Taranto, Brindisi and Pola. These lights, however, are on only when so ordered by the command of civil aeronautics or the Admiralty.

In Italy, there is at the present time, quite a mess of civil, military and naval aviation with no well defined limits, and interfering with each other, thus handicapping any civilian initiative for establishing regular aerial services in Italy. The public press, the Aero Club and the Society of Aeronautical Engineers, have been lately conducting a quite lively campaign in order to have this tangle straightened out and for obtaining the establishment of a healthy civil aviation in Italy, and all indications are that in the course of the current year something will be done in that direction.

Italy, due to its geographical position in the middle of the Mediterranean is a very important jumping off point for the international lines plying between central Europe, the North African Continent, and the Balkans, and there is no doubt that as international aerial lines are established and developed, Italy will play a rather important part in the commercial aviation game, especially considering that the aircraft manufacturing industry there is capable of producing good aircraft at a good price.

The aeronautical activities of Italy, so far, have been limited to a number of raids and competition in international aero-

nautical events where the Italians have obtained a number of important prizes during the last two years.

GERMANY

We have seen so far that one of the reasons why commercial flying has not been a financial success in France, England, Belgium and Italy is that the aircraft used for commercial services were not adapted to the kind of service required of them. In almost any case of commercial exploitation by aerial lines in Europe, aeroplanes which were originally designed for war services were modified so as to allow for their being used as commercial carriers. This handicap, under which commercial aviation was born in Europe, is due to the enormous number of military aeroplanes left over when the war stopped.

The aircraft manufacturing industry has also been handicapped by the fact that aeroplanes were sold by the Governments from the stocks left over after the demobilization, at such a price that aircraft manufacturers could not compete with the Government in selling their products.

In Germany, we find an entirely different condition prevailing after the war. The treaty of Versailles practically wiped out all aircraft existing in Germany at the time when the Armistice was signed. All the aeroplanes and flying equipment had to be handed over to the Allies so that Germany, right after the war found itself with no aeroplanes.

Two opposite tendencies were shown in the supreme council regarding the future of aeronautics in Germany. French, Italian and Belgian experts were in favor of prohibiting to the central empire the construction and the use of flying machines (both aeroplanes and dirigibles) for an indefinite period of time, until such a date as the rest of the world might feel confident that the defeated nations had abandoned any projects of future aggression. This tendency was opposed by English and American delegates, who finally succeeded in carrying the point.

The decision arrived at was that military aeronautics had to be suppressed in Germany, that all the existing aeronautical material had to be either destroyed or handed over to the Allies, but at the same time it was agreed that commercial aeronautics could be born in Germany, although a number of limitations were imposed on the German aircraft manufacturing industry, which, however, inside of the next few months will be entirely removed, Germany having complied with the conditions imposed on them by the Treaty of Versailles.

Due to the situation brought about by the Peace Treaty, commercial aviation was born in Germany without the handicap of the existing large number of war aircrafts, which in the other countries made it difficult for the aircraft manufacturers to design and manufacture commercial aeroplanes well adapted for commercial use, when such large numbers of aeroplanes could be bought at an extremely low price from the Government and transformed in a more or less inefficient way to commercial use.

The consequences of the situation is that since the war, Germany has developed some exceptionally good commercial aeroplanes, and has built a fleet of such planes which are far superior to those used by the other nations. They are more efficient, and better adapted to commercial exploitation. They are so much so that the progress made by Germany in aeronautical construction is eliciting some uneasy feelings throughout the rest of Europe. On October 13th, of last year, in an editorial appearing in the *London Times*, some sanctions against further expansions of German aeronautical activities were invoked. It was pointed out in that editorial the very obvious fact that the technical progress made by the development of the aircraft manufacturing industry in Germany constituted a potential military danger for the future, considering the fact that a commercial aeroplane can, without much trouble, and in a very short time, be transformed from a commercial flying machine to a war engine. These conclusions are obvious and they are well in accordance with the opinions expressed by the French, Italian and Belgian experts advocating the suppression of all aeronautical activities in Germany for an indefinite period of time. It is rather surprising that in some British quarters, anxiety should be voiced at the present time about the future of German commercial aviation, which is indebted for its very existence to the British and American stand taken in the Supreme Council.

Anyway, at the present time, nine strong and well organized aerial transport companies are in existence in Germany, and are making plans for future developments, which shall be particularly interesting in establishing communications between Germany, Sweden, Holland, the Balkan States and Russia. In Russia, especially, we might expect that the Germans will be in the future a dominating factor of the establishment and development of aerial transportation.

It seems that aeroplane service over a direct route between Germany and Russia will be put in operation in the spring, cutting the time between Berlin and Moscow to only 22 hours.

Aeroplanes will be used from Moscow to Koenigsburg, where arrangements will be made for direct connections with night trains coming to Berlin. The new German-Russian aircraft company, which has just been organized for this purpose, is financed by the Russian Government and by the Aero Union. The latter is owned by the Elektrizitäts Gesellschaft, the Hamburg-American Line and the Zeppelin Airship Company.

It is worth mentioning here that the plan of establishing connections with Russia and the rest of Europe, was conceived by France as early as the summer of 1920 when negotiations were started between the Denikine Government, the Russo-Asiatic Bank and a group of French aircraft manufacturers for the establishment of aerial lines in the Donets Basin for the transportation of mail and freight.

The proposal advanced by the Russians was, first: that French aircraft manufacturers were to supply the flying materials needed, aeroplanes, equipment and spare parts. A company would have been started for the exploitation of the aerial lines, and French aircraft manufacturers would become stockholders in this Company to the extent of the sale price of the material furnished, the balance of the capital needed being subscribed by the Russo-Asiatic Bank. The dividends of such a business enterprise being paid to French aircraft manufacturers in fuel for an equivalent value. These conditions were accepted by the aircraft manufacturers with the exception that they asked that half the price of the material supplied by them, be paid in francs, so that they might become stockholders in that company to the extent of one-half only of the sales price of their material. The payment of dividends in fuel was accepted. These negotiations could not be brought to a conclusion on account of the downfall of the Denikine Government, but the points agreed upon show at least that French aircraft manufacturers were willing as early as two years ago to risk their benefits in such an enterprise. Apparently the Germans have now succeeded in entering into an agreement with the Soviet Government in Russia for establishing aerial communications between Germany and Russia. There is not the least doubt that the first initial step will be followed later on by further expansions.

When we consider the large land extent of Russia, the rudimentary state of railways, the great distance separating commercial centers and the enormous commercial opportunities to be found in Russia, we can easily realize how important it will be to establish and operate lines such as Petrograd-Moscow, Kieff-Odessa-Italia or Petrograd-Moscow-Kharkoff-Wladkovkaz, covering these distances in 24 hours. The trip Moscow-Tokio or Moscow-Pekin, trans-Siberia lines, could be made in three days. The international line Paris-Moscow in 24 hours, Berlin-Warsaw-Moscow in 18 hours, Odessa-Bukarest in 3 hours, Petrograd-Stockholm in 5 hours, Petrograd-Copenhagen in 9 hours, Odessa-Constantinople in 4 hours, Odessa-Vienna in 6 hours, London-Calcutta passing through Tarnopol, Astrakan, in three days, are of such importance that I do not need to emphasize.

Various lines are now in operation in Germany between Berlin-Leipzig, between Nuremberg, Munich and Augsburg. The operating companies are subsidized by the Government and the Deutsche Luft Reederei of Berlin, in 1920, received 15 millions of marks subsidy from the Government. The company is one of the most important and the best organized of the aerial transport companies in Germany.

At the general meeting of the Deutsche-Luftfahrerverband on October 22, 1921, the consolidating into one single company of the Deutsche-Luftfahrerverband, the Aeri-Klub von Deutschland and the Allgemeine Deutsche Flugverband was decided upon. The new company thus formed will take the name of Deutsche Luftfahrtverband.

Most of the aerial lines in Germany suspended their activities in October of last year and the service will not be resumed before March, 1922. In the meantime, it is most likely that new lines of operation have been taken into consideration and by next summer we might anticipate quite a lively start of commercial aviation in Germany.

Besides the aerial lines as mentioned above, another line was opened last year between Dantzig, Koenigsberg and Memel. Also in September of last year a line between Riga and Reval was opened up. This line is operated in connection with the Dantzig, Koenigsberg, Memel, Riga line.

Departure from Dantzig taking place three times per week: Monday, Wednesday and Friday, starting from Dantzig at 9 A. M., starting from Koenigsberg at 11 A. M., and starting from Memel at 1 P. M., arriving at Riga at 3.30 P. M.

Departures take place from Riga every Tuesday, Thursday, and Saturday, starting from Riga at 10 A. M. arriving at Reval at 12.30 P. M.

For the return trip, departures from Reval occur every Monday, Wednesday and Friday, starting from Reval at 1 P. M., arriving at Riga, 3.30 P. M.

Departures from Riga every Tuesday, Thursday and Saturday. Starting time from Riga, 9 A. M., starting time from Memel, 12 noon, departures from Koenigsberg at 2 P. M., arriving at Dantzig at 3.30 P. M.

Mail matter is accepted on this line with ordinary postage stamps for foreign mail. Mail matter starting from Berlin can reach Riga after 38 hours. This is the first attempt to start Air Mail Services in Germany.

Before concluding, we might add that scientific research work in aerodynamics and sciences thereto allied has been conducted throughout the war and since the war by the Germans with the most gratifying results, in fact, we might safely

say that the Germans have contributed to the development of aeronautics as a science and as a branch of engineering more than any other nation up to the present time.

In dirigible construction it is well acknowledged by everybody, the leadership of the Zeppelin and the Schutte-Lanz firms in rigid dirigibles design and construction. Also in metallic aircraft construction, the advancement made by Germany in this line is well known. Metallic aeroplanes made by Junkers, by the Zeppelin firm and by Dornier are well-known, and it is admitted by everybody that in this line of aircraft manufacturing industry, the Germans are so far unexcelled by other nations. (To be concluded).

THE AERIAL JOURNEY FROM LONDON TO PARIS

A SCOTCH clergyman, Rev. H. S. McClelland, writes an interesting story of his journey by air from London to Paris in a recent issue of the *Glasgow News*, as follows:

"The day on which I travelled by the London-Paris air mail, the conditions were perfect for flying; scarcely a breath of wind on the ground, hardly a cloud in the sky. We arrived at Croydon (London) about 10:15. Here are the offices and aeroplane sheds of all the great air lines to the Continent—the Handley-Page, Instone, Grand Express Aeriens, &c., each flying its own 'balloon.' A huge star in red sandstone marks the center of the aerodrome. Away to the left the new anchoring mast for airships rises several hundred feet in the air. A score of aeroplanes de luxe, all of them of tremendous wing-spread and colossal engine-power, line the ground, round one of which, a huge Vickers-Vimy, Rolls-Royce, Limousine, of 470 h. p., a group of mechanics are busy. We knew instinctively that it is for us they were waiting. Five minutes more and we are through the Customs, have had thirty pounds of free luggage carefully weighed, and are being helped into the car of this eviathan of the air. I found myself sitting in a well-ventilated saloon with ample room for movement. There were eight passengers in the car, and we sat four-a-side, with a small passage down the middle.

"Through the window I can see our young pilot putting on his air-mask. A yellow bag, wax sealed, is handed to him. It is the air mail. He flings it into the driving seat and jumps in after it. Down below several mechanics in brown overalls are swinging the long blades of the propeller to and fro. My watch records half past ten.

"'Stand clear!' rings out an order. 'Contact! Contact, sir!' The great engine pens with an earth-shaking roar, and grows louder and louder. Someone kicks the blocks away from the runners. The huge machine leaps forward like a greyhound from the leash, and gathering speed as it goes, it travels at a terrific rate for the end of the aerodrome. This, of course, is the critical moment of the ascent. We appear to be making straight for a clump of reeds. If we don't take the air soon . . . Ah! I thought so. The jolting, bumping ceases, and the slight roll from side to side tells us that our 'runners are up,' that we have left the ground. Now we are facing the aerodrome again, but the sheds are several hundred feet beneath us, and a group of Lilliputian figures are waving us arewell. Rapidly we climb to five thousand feet, and the scene below grows passing strange. The dull yellow daubs, with the ditches between them, that marked the southern suburbs of London soon pass behind the Kentish hills. Now we are pass-

ing over open country, where the cultivated fields look like the tiny squares on a patchwork quilt, whose dominant colors are green and gold. Toy motor cars, with clouds of dust behind them, crawl sleepily along the white road-ribbon that covers the country side. It is interesting to study the various patterns of the corn-sheaves that are standing in the yellow fields. The black threads that seem to tie the towns together are railways, on one of which a train is disappearing into a tunnel. It looks like a tired worm crawling wearily into its hole. Those black spots, here and there, are farmsteads. Towns you see long before you reach them, and you see them all at once. They never look beautiful from the air. They remind one of warts.

"That shining string of diamonds is the Medway, dancing in the sun. All this you see if you look down. To look straight out of the window is to see the huge struts and mighty wings of this great bird of passage, upon which for another hour our very lives depend. The aeroplane rolls in the air like a ship. Some of our number are showing signs of air-sickness, though 'air pellets' were given to us all before we embarked, with fullest instructions as to their use if we 'felt queer in the air.'

"We left the English coast at a quarter past eleven, somewhere between Hythe and Folkstone. We had descended to 1,500 feet and could plainly see the watchers on the sands. No language of mine could describe the magic of that crossing. Behind us the rolling downs of Kent; beneath us the dancing waters of the Channel; before us the pine-clad sand-dunes of the Pas de Calais. Only five ships of any kind were visible beneath us, the largest of them a P. and O. liner, looking like the sort of thing the London children play with on the Round Pond in Kensington Gardens.

"But already the Irisnez lighthouse was poking its long nose up at us as we passed over her, Boulogne was spreading itself out beneath us, has passed behind us, and we were flying above the ruins of the British hospital camp on the brown Etaples sands. I looked at my watch. It was exactly eleven minutes since we left the English shore! We now turned due south, but climbed gradually to six thousand feet to get above the haze driving in from the sea. Little could be seen with any clearness from that altitude, save the long, straight public roads for which France is so famous, with the black shadows of the poplars lying flat on the white surface. As we passed over Montreuil, about 11:45, for three years the British Army G. H. Q., I found myself wondering how many German bombing planes had searched these areas in vain. Twelve o'clock found us flying over the battlefield of Crecy. A few minutes later Abbeville lay behind us, and we were across the wide estuary of the Somme. We had now been in the air for

nearly two hours, and even for our youngest passenger, a young girl of seventeen, the novelty of the experience was passing. We began to take more note of each other. A passenger in the back seat is reading a French novel. Several of us are busy photographing the interior of the saloon, and vainly attempting to get 'exteriors' as well. One timid friend, to whom courage is now returning, asks his neighbor to try a snapshot of him! 'I guess I'd like a memorial of this fool trip,' he says, 'for they'll be flying to Mars before I take another!' 'What do you mean?' replied a Toulouse pilot. 'What do you mean, you'll never have another? Why I'll be flying you next week to Rabout!' 'I guess you won't,' drawled the American, 'the next time I'm up as high as this, the good Lord'll be takin' me to glory!'

"It was now 12:40. We had passed over Poix and Crevecœur, Beauvais and Pontoise, when, away in the distance, with the silvery Seine, like a shining serpent, winding all about her, I caught my first glimpse from the air of the gay French capital, nestling like a jewel in a velvet casket, in the woods of Chamberg and Versailles. Suddenly, and to most of us unexpectedly, for we were still a long way from Le Bourget, the roar of the great engine ceased, the air became strangely still, and we felt ourselves falling earthwards, and turning as we fell. Our American friend kept his eyes fixed on the height indicator. 'Six thousand feet!' he read breathlessly, 'five thousand, four thousand, three—' With a mighty roar the engine started again. We rose rapidly a thousand feet, turned on our track and came down in a sweeping curve. The American could stand it no longer. 'For God's sake, Mr. Pilot,' he cried, 'don't change yer mind! Keep on goin' down. Keep on goin' down!' The pilot evidently knew his own mind quite well. We came down the remaining half mile in a series of volplanic spirals that landed us right over the star in the center of the aerodrome.

"We landed at 12:46, having covered the 260 miles between the two capitals in two hours and a quarter, an average of two miles a minute! Half an hour later I was lunching at the Hotel Continental with some of my fellow adventurers. 'What are you doing with yourself this evening?' I asked of one of them in whom I had already found a friend. 'I'm thinking of going to the "League of Notions?'" he replied. 'Do you know anything about the show?' "'The League of Notions?'" I answered in great surprise, I didn't know that was to be seen in Paris.' 'It isn't,' came his quiet answer. 'I'm flying back to London by the four o'clock plane.'"



NAVAL *and* MILITARY AERONAUTICS



Air Service Denied Participation in National Rifle Matches

The Army Air Service has found it necessary to abandon its plans for participation in the National Rifle Matches to be held at Camp Perry, Ohio, this coming fall. Basing his request on the fact that the Executive Committee of the National Board for the Promotion of Rifle Practice contemplates the participation in the National Rifle Matches of a team from each of the combatant arms of the Army, the Chief of Air Service, on February 27, 1922, made application to the War Department for the participation of the Air Service in these Matches, stating that the necessary personnel to form a team is available this year, and that such participation in these Matches would stimulate interest in the manipulation of small arms among both officers and enlisted men. It was also stated that it is planned to assemble about 42 officers and enlisted men, exclusive of a team captain and team coach, at the National Guard Rifle Range at Virginia Beach, Va., on or about June 1st, for preliminary training and tryouts, after which a final selection would be made of 24 men who will proceed to Camp Perry as the Air Service contingent.

The War Department's decision, disapproving the application, is based on the fact that only about one-third of the entire personnel of the Air Service is armed with rifle, and that the units are so equipped merely for purposes of defense.

Students Finish Primary Training

The Academic Board at Carlstrom Field met on March 7th for the purpose of passing and making recommendations on the class of student officers and cadets who commenced the course last September and who have now completed their primary training. Some fourteen officers and twenty-five cadets appeared before the board and were recommended for advance training, 10 per cent. of the class being assigned to pursuit training, 25 per cent. to bombing and 65 per cent. to observation. Orders have been requested for the assignment of this class to advance training schools.

Reserve Squadron Stages Aero Circus

San Jose, California, the home of the 440th Aero Reserve Squadron, was treated to an unusual event the latter part of February, the occasion being the Flying Circus held at that place under the auspices of that squadron. Some of the commissioned personnel from Crissy Field, Presidio of San Francisco, Calif., including Major George H. Brett, commanding officer; Captain A. W. Smith, Flight Surgeon, and Lieutenants Batten, Maxwell, Kiel, Liggett, Patrick and Catlin, flew to San Jose to witness the event. The Circus attracted approximately 20,000 spectators and had successfully run the gauntlet of aerial stunts peculiar to aerial circuses, such as spectacular stunt flying and aerial acrobatics, with Mr. Pangborn, civilian pilot, Captain Lowell Yerex, famous English "Ace," and "Jinx" Jenkins, known from one end of the Pacific Coast to the other for his feats of aerial daring, as the principal participants, up to the last act.

As has been the case during previous circuses in which "Jinx" Jenkins had participated, he was concluding his performance with a parachute jump from an altitude of approximately 2,500 feet. He had scarcely jumped from the plane, however, when it was evident to the horror-stricken onlookers that his parachute had failed to open; and despite desperate struggles up to almost the very moment when he struck the ground, "Jinx" was unable to make his parachute function. "Jinx" numbered amongst his friends many of the officers at Crissy Field, and the untimely death of this young man is sincerely regretted by all who knew him.

Boosting Aeronautics in California

At a meeting held on February 28th at the City Hall of San Francisco, an Air Service sector of the Association of the Army was organized. Major H. H. Arnold, Service Air Officer of the 9th Corps Area, was elected President thereof, and 1st Lieut. Robert E. Self, Air Service, of Crissy Field, was chosen Vice-President. The object of this organization is to foster aeronautical development in general, and to create and aid in every way possible among the various branches of the Army interest in matters aeronautical.

Aero Tactical Demonstration at Luke Field, H. T.

Luke Field, H. T., was the scene of a tactical program demonstrating the different phases of aerial activities under war conditions, on Saturday, February 11th, on the occasion of the visit of Major General C. P. Summerall, Commanding General, Hawaiian Department, on a tour of inspection, accompanied by Governor Farrington of the Territory of Hawaii. All planes were on alert. At the zero hour an HS2L seaplane took off on a reconnaissance mission, Ford's Island representing the Island of Oahu for this mission. Radio communication was established between the seaplane and the Group Radio Station (5th Group, Observation) and the observer of the seaplane reported the approach of the "enemy." Upon receipt of the message requesting that an air force be sent to drive off the landing parties, the alarm was sounded, the motors started and in a very short time five planes took off in perfect formation and carried out a dive attack and bombing raid in the harbor representing the "enemy." At the conclusion of the raid, the planes passed in review, all observers at salute. The Commanding General returned the salute and the planes circled and landed.

Next came a bombing raid of the island by one ship over the camera obscura making four shots up wind until engaged and driven off by the Fokker. Lieut. Miller then demonstrated the maneuverability of the Fokker. The bombing plane then carried out a radio-panel communications mission, establishing communication between the plane and radio truck set upon the field. At the conclusion of the mission, the message was dropped and checked made of all the shops and departments, including the barracks of the 6th Squadron.

M. B. VII Makes Another Trial Flight

The little monoplane of the Thomas-Morse Aircraft Corporation which is being tested at Mitchel Field, L. I., New York, was given its second flight on with the record at the truck. Following the flying program, an inspection was March 10th by Lieut. Fleir of the Marine Corps. The officers of Mitchel Field were eager spectators as Lieut. Fleir drove the little racing plane around the course. Again, as before, all were of the opinion that the MB VII will develop great speed. Lieut. Fleir thought she was making at least 185 miles per hour at one time. He only opened the motor up on one occasion, and then only for a brief time.

Post School at Mitchel Field Makes Gratifying Progress

After its first experimental week, the Post School at Mitchel Field settled down to its task of giving a rapid one month's course in the necessary subjects to fit a recruit or unskilled soldier for a crewman. The weekly examinations on Friday, March 10th, served as a means of eliminating those who are unfitted, by reason of lack of intelligence, education or industry, to stand the strain of rapid progress of the classes. Those who yet remain, however, about 150 in number, are working hard, making progress, and will be turned out on April 1st with sufficient knowledge of airplane and airplane motor mechanics to make them serviceable crewmen for the summer's strenuous flying activities.

Air Service Observation School in Full Swing

The ending of the sixth week at the Air Service Observation School at Post Field, Fort Sill, Okla., finds the present class beginning class room work. To date, all work has been strictly practical—actual work on engines and planes, in addition to flying, has obtained. The seventh week brings up the theory of Reconnaissance, Photography and Artillery adjustment. These subjects occupy one-half of each day, the other half, as heretofore, being devoted to flying.

The School was visited the early part of the week by a delegation of Japanese Army officers. They were shown the various activities and seemed to take much interest therein. A problem was fired for them on the miniature range. The speed and facility with which artillery fire may be directed on a target by aerial observation was very well demonstrated to the gratification of the visiting officers.

The next eight weeks will constitute the most difficult part of the course. During this period a great variety of subjects will be covered, and some thirty missions will be flown by each student, in addition to the daily routine flying.

The past week has brought with it a variety of good and bad weather; the latter, however, has had little effect upon the schedule, due to the alternate work prepared. With spring, work should proceed very smoothly, and the indoor part completed, leaving only the final stages of flying to be accomplished.

FOREIGN NEWS

France's Great 1924 Competition

From France it is reported that the prize of one million francs offered by the French Society for Aeronautical Propaganda for the "best" aero engine will probably be augmented by another million offered by the French Air Minister. But few details are to hand at the time of going to press, but it appears that the competition will be for engines of 350-450 h.p., and weighing not more than 2 lbs./h.p. It is understood that competing engines will have to pass a reliability run of 240 hours, in stretches of eight hours each, and that the total time taken in completing the 240 hours must not exceed 100 days. The competition will start on March 1, 1924, and entries must be received before December 1, 1923.

Belgian Aero Club Competition for Touring Machines

Details of the International Competition for Touring aeroplanes organized by the Ae.C. of Belgium at Brussels on June 23-25 are now to hand. The competition is open to touring machines, single-seaters or multi-seaters, whose engine capacity does not exceed 7 liters. The course is to be Brussels-Gosselies (landing) 47 km. Gosselies-Brussels-Brussels-Gosselies (landing) 141 km. on Saturday, June 24. The awards will be made for a total of 100 points, allotted as follows: 30 points for minimum of space occupied in the garage, 30 points for general economy of the engine, 25 points for slow landing, and 15 points for quick get-off. The machines entered must be on the Evere aerodrome at Brussels before noon on June 22. The prizes are as follows: The King of Belgium's Challenge Cup, to be retained by the winner for one year; and the following cash prizes: 1st prize 15,000 francs; 2nd prize, 7,000 francs; and 3rd prize, 3,000 francs. All enquiries should be addressed to Secretariat de la Commission Sportive, Aero-Club de Belgique, 73, Avenue Louise, Brussels. The entrance fee, returnable if machine starts, is 100 francs, and should be sent to the Treasurer of the Belgian Aero Club before June 10.

Cairo-Bagdad Air Mail

The British Postmaster-General stated on March 2 that the air mail which was dispatched from London on February 9 reached Bagdad on February 27. The mail due to be dispatched by air from Bagdad on February 18 reached Cairo on February 23, and letters included in it for England arrived in London on March 3.

French Air Traffic

The French Department of Aeronautics and Air Transport has issued a statement giving traffic figures in connection with the progress of commercial aviation in France during the years 1919, 1920 and 1921. Considering the handicap under which aviation has been carried on by the companies concerned, these are very encouraging. The following is a summary of the official figures:—

Year.	Journeys made.	Miles covered.	Passengers carried.	Parcels lbs. (approx.).	Letter Mails, lbs.
1919	988	158,606	588	14,000	900
1920	2,386	529,454	1,721	110,000	9,000
1921	6,221	1,457,437	10,336	375,000	21,000

Figures which are available for the air mail between France and Morocco for 1921 are also very instructive. In the "round" journey there and back the increases have been very marked. In January, 1921, the total was 16,377 letters; in January, 1922, the number was 50,851, equal to over 300 per cent. increase. Curiously, the dispatchings from Morocco to France were greatly in excess, viz., 32,691, as against 18,160 in the reverse direction. So steady has been the growth of the air mail that it has determined the Secretary of State to augment the facilities by increasing the service between Toulouse and Casablanca from three to five times per week as from this month—necessitating a fleet of 90 craft. The following monthly figures of letters carried during 1921 speak for themselves:—

February, 12,025; March, 14,005; April, 17,179; May, 18,878; June, 22,738; July, 28,108; August, 34,283; September, 35,006; October, 40,601; November, 41,330; December, 47,235.

"Safety First" Air Prize

A prize of 25,000 francs is offered by the French "L'Union pour la Sécurité en Aéronautique," for the best safety device or scheme for flying in fog or at night submitted during 1922. Details governing the award are not yet available, but those interested can communicate with the Association at 35, rue Francois-Ier, Paris.

Seaplane Contest at Marseilles

It is announced that the Aviation Committee of the Colonial Exhibition, to be held at Marseilles this year, have definitely decided to organize a contest for seaplanes from April 17 to 19. There will be three categories: under 150 h.p.; 150 to 400 h.p.; and over 400 h.p. Eliminary trials are to take place on April 17 when entered craft must ascend to 1,000 meters, and have on board, in addition to the normal useful load, sufficient fuel for 1½ hrs. flight. The course, Marseilles-Monaco, is 413 km. Prizes to the extent of over 40,000 francs are offered. An entrance fee of 200 francs (returnable in its entirety) obtains, and communications should be addressed to the Aviation Commission, A. C. de France. Military competitors will take part *hors concours*, a trophy being their recompense.

To Improve Upon "Landing" on Water

In France our contemporary *L'Auto*, has raised the point of finding a verb better to define "landing" on water. Suggestions, weird and otherwise, are naturally forthcoming, amongst them being aquair, aquater, and afflotter. For our own part, we get over it by putting the trouble on to "alighting."

Gliding in Germany this Year

From reports from Germany it appears that the gliding competitions which started on quite a modest scale a couple of years ago are to assume greater proportions in the future. Not only are the Rhön competitions to be resumed this summer, but it is stated that a new prize of 100,000 marks is to be offered for the first German glider which makes a flight of 40 minutes' duration over a course similar to that of a yacht race. Presumably this means over a triangular course. The prize, it is reported, is to be offered by the Society of German aircraft constructors, after consultation with the German Aero Club, and the German Aeronautical Society. The conditions are sufficiently difficult,

coupling as they appear to do a duration of 40 minutes with a specified course. One or the other might be fairly easily attainable, but the combination of the two is so difficult that one doubts whether the prize will be won for some considerable time.

Mountain Reconnaissance by Air

An officer of the Geodetic Mission in Syria has carried out recently an aeroplane reconnaissance of the zone which he is engaged in surveying. The object of the experiment was to prove whether it was possible by flying over a region, such as the anti-Lebanon Mountains, to get an exact idea of the differences in height of the summits and consequently to be able to select the points to be used as a basis for triangulation. The experiment proved very satisfactory and several weeks' time was saved.

German Aviation

The following is a translation of an article by Lieut.-Colonel Reboul of the French Army, which appeared in a recent issue of the French publication *Le Temps*:

The Ministry of War of Germany has just published regulations which enlighten us on the state of mind of the German High Command and its designs. The "Instruction on the employment of aviation to be used for maneuvers, regimental exercises and drills in tactics" is a statement in concise form of the opinions of the German High Command on the employment of aviation during the war.

Article 198 of the Treaty of Versailles prohibits Germany from keeping any aeronautical force whatever. This, however, does not prevent the Minister of War from declaring in this instruction: "In the distribution and employment of the aviation formations we have taken as a basis a modernly equipped army for use in giving decisive combats." It does not prevent the cadres of the *Reichswehr* from already undergoing training in the use of the aeroplane. In their *kriegsspiele* they assign missions to it and receive information from it. They are accustoming themselves to handle it, to consider it as an arm, the collaboration of which is indispensable. They are making preparations to use aeronautics in connection with the other arms.

Doubtless the *Reichswehr* will be unable to begin the actual exercises so long as our control commissions remain in Germany. But the day they leave, the "Instruction on aviation" will immediately be put into effect. The plan being already known to all, it would require but a short time to put it into operation and have an aviation force working in close union with its command, its infantry, its artillery and its cavalry.

Chapter II of the regulations treats of the aerial formations. It provides for an exceedingly high aviation equipment for each large unit.

The Infantry division includes organically a strong squadron of two escadrilles. One of these, the reconnaissance escadrille, will be used for close missions and for observation of the battlefield. The other will work with the divisional artillery. Each of these escadrilles comprise 12 aeroplanes. The German army thus realizes the desiderata which we expressed at the end of the campaign of 1918. The division is henceforth permanently equipped with its eyes and observers. Its aviation will work constantly with the same units. They know one another wonderfully well; they have confidence in one another; they conform to one another's customs and idiosyncrasies. The results will be incomparably greater than those obtained with escadrilles that are assigned only temporarily to the divisions. At the moment that everyone begins to speak the same language the escadrille is replaced by a new one. Everything must be begun all over again.

The army corps has its own squadron which has the same composition as the divisional squadron. Its reconnaissance escadrille will specialize in photography and in night reconnaissance; its artillery escadrille will regulate the heavy artillery firing of the army corps.

The army is very strongly equipped with aviation units. The regulations provide for the assignment to it of one observation squadron, combat squadrons, pursuit squadrons and bombarding squadrons.

The observation squadron is of the same type as the divisional squadron; but its aeroplanes will as a rule be superior. They will, in fact, penetrate more deeply into the enemy lines. The reconnaissance escadrille will make distant reconnaissances and photographs of the enemy's rear areas. The artillery escadrille will regulate the fire of the high powered heavy artillery which will be directed against the enemy quarters, its parks, railways, installations and points through which it is compelled to pass.

Each army in active operations has assigned to it a combat unit with a strength of 3 or 4 squadrons. Each squadron comprises 4 escadrilles of 12 aeroplanes each. This represents a body of 150 to 200 aeroplanes which will have as its mission to take part in all the phases of the battle, both in aerial combats and in combat against the other arms. In an attack it will act with the assaulting troops, will precede the first waves, mowing down the enemy reserves and bombarding the centers of resistance.

The pursuit unit will be especially charged with the aerial fighting. It comprises from 4 to 6 pursuit squadrons, each squadron comprising 3 escadrilles of 21 planes. Its mission is to hinder the enemy reconnaissance and prevent the enemy combat aviation from taking part in the battle. It must enable its own reconnaissance aeroplanes to accomplish their mission. Its object is aerial combat. Pursuit planes should act in mass so as to be master of the air, at least during certain hours. They may be reinforced for certain missions by combat and bombarding squadrons.

The bombing aviation is less strong numerically than the combat and pursuit aviatis. It consists of from 1 to 3 squadrons, each formed of 3 escadrilles of 12 planes. It is to be used in bombarding by day as well as by night.

The group of armies has only a very limited aviation force, which consists of one escadrille of 12 planes for making reconnaissance which are of special importance to it and which it wishes to entrust to observers whom it knows and can rely upon, and one artillery escadrille of 12 planes for the long-range and very mobile guns, especially those on railways, which it fires now in one direction, now in another.

The General Headquarters reserves a few combat and pursuit squadrons both for its own safety as well as for an aerial reserve. It will itself conduct the fighting against vital points in the enemy's back areas by means of bombing squadrons and giant aeroplanes which it will bring into action.



A Study of the Vulture and Golden Eagle

(Continued from page 89).

WHEN one goes still-hunting for a Tawny Vulture, upon first coming into sight he does not appear to be a large bird. At the altitude at which he habitually soars he appears to be about the same size as the Kites and the Egyptian Vultures—he makes no more impression than they. One learns quickly to distinguish him by the angle to the front produced by his wings, by the absence of wing beats, and above all, by the slowness and steadiness with which he moves in space. This is an infallible sign by which to recognize him as far as the eye can distinguish. It is only later that his true size will be understood, when he is only 100 or 300 yards off. As he approaches within that distance he grows in appearance much faster than the other birds.

He is further distinguished by the peculiar spread of his wing tips. This is the bird who spreads his primary feathers most widely apart. At the extremity there is an open space between each quill equal to about five times the width of the feather.

Still another peculiarity is that the primary feathers, instead of tapering toward the point, are constructed on the reverse plan; they seem to be implanted into the wing by the thin end, the outer tip being materially wider than the part which seems to be attached to the wing and which precedes the main widening of the barbs. These large feathers, widest at their tip and spread asunder, present a curious outline which would please artists greatly if they observed this bird in his native habitat.

To the peculiar construction described we must add the effects of the partial rotation of the quills within their sockets, which action is observed only in these large birds. The quills must be wonderfully strong and elastic, for the birds put them to severe proof. During the efforts which he makes when starting up from the ground and when his pectoral muscles are doing their utmost, the tips of the feathers point directly to the zenith. In short, from every point of view these great birds are exceedingly interesting to observe when free. There are attitudes quite unknown to those who see the bird only in museums.

But there must be freedom. Otherwise we have only Eagles motionless as milestones, or ill-smelling Vultures apparently worrying themselves to death, their heads smothered between their shoulders, two aspects which have nothing in common with that of these kings of the air proudly traversing the immensity of the skies. One circumstance which frequently deprives the observer of the chance of witnessing their interesting evolutions is the bird's alarm. At the slightest apprehension, these great creatures resort to rowing flight, seeking to get rapidly beyond danger. So, developing all their powers with strokes of wing, they quickly fly away.

Their power of vision must be great; we may safely assume

this, because these birds, of all flying creatures, are those whose mode of life requires the most extensive views.

A sparrow needs a field of view of but a hundred yards. A more powerful organ of sight would be needless, and therefore atrophied in a few generations. The sea birds need to observe the surface of the waves for only a dozen yards or so. It is not among these creatures that those perfect lenses are found, capable of collecting all divergent rays of light.

The hunting birds of prey, such for instance as the Falcon and the Eagles, often scrutinize the surface of the ground from a great height. The latter birds sometimes remain at an elevation of 400 or 500 yards while hunting, but what is the distance when compared with the 3 or 4 miles required by the Vultures to study their field of research?

We may safely conclude that the constant necessity for seeing further than other birds has caused them to acquire in the organ of vision a perfection not possessed by other birds. We must therefore render ourselves invisible to them in order to be able to witness their extraordinary evolution when sailing. Or, better still, we must seek them in the primitive countries where they have not yet learned to be afraid of man, and even there, clothes which shall not attract attention should be worn, for otherwise they will not come down to a meal.

Unfortunately the Vulture is an unknown bird to those interested in the problem of soaring flight, for comparatively few people have seen him in the air. In Algeria, even in Cairo (where there are some sailing over the city every day during three months of the year) most of the European residents are unaware of their existence. But when the student takes the pains to go where the bird is to be found; when he sees this great animal, large as a sheep, painfully rising from the ground with strokes upon the air whose hissing he heard 300 yards away in the silence of the desert; when he sees them afterwards describing their endless sweeps, he appreciates this most interesting sight—every human being chained to the spot. Even the Arab is stirred to emotion, for in this bird we have found motion under a new aspect. As to majesty and impressiveness, it resembles the action of locomotive at full speed.

When we watch a Martin flashing through space we think of high speed mechanism; when it is a snipe or partridge which flies off, we are reminded of the action of a released spring; a gull suggests perpetual motion or the endless sweep of a pendulum, but the view of the great Vulture in sailing flight inspires at once the desire for imitation. It is a dirigible parachute which man may hope to reproduce.

The Great Golden Eagle

Undoubtedly the Eagle is the king of birds. He possesses strength and courage. Having no enemy his equal, he peacefully passes long days in the beatitude of uncontested autonomy. (To be concluded)



Anatomy of the Golden Eagle. Weight, 10 pounds. Loading, (wings only), 1.6 pounds per square foot. Wing span, about 6 ft. 10 inches.

ELEMENTARY AERONAUTICS and MODEL NOTES

A Flying Scale Model of the Fokker F III Cantilever Monoplane

FOLLOWING the correct proportions of the Fokker-Cantilever monoplane, Mr. M. J. Bayhi of Hempstead, Long Island has designed and constructed an attractive and efficient 36-inch scale flying model. The outlines have been carefully copied in reduced scale, resulting in one of the finest scale model designs of its class.

In a model of this character, opportunity is afforded to apply some clever workmanship in the wing construction. On account of the deep section required for the cantilever bracing, and because of the absence of external stays or supports, the wing structure is built up in an unusual way. The ordinary wing spars are replaced with light stringers which stiffen the wing and give good support to the ribs.

Measurements are as follows:

Wing span (with balanced ailerons)	38 3/4"
Length over all	27 3/4"
Height at wing	9 "
Wing chord, at fuselage	6 1/2"
Wing chord, at tip	4 3/8"
Size of landing wheels	2 "
Propeller diameter	12 "

A record was made of the weights of each separate part, accurate to within one-one hundredth (1/100) of an ounce. These weights total up to nearly 9 ounces for the complete model. The wing weight includes the aileron weight also. The fuselage weight includes also the weights of landing gear, tail unit and power unit. Landing gear weight includes wheels. Tail unit comprises the rudder, stabilizer and elevators.

List of Weights:

	Ounces
Model complete and ready for flight.....	8.96
Wing	2.30
Fuselage complete	6.66
Landing gear	1.32
Tail unit .....	.21
Propeller .....	.94
Power plant (not including propeller)	2.22
Rubber power	1.30
Cowls .....	.48

General Description

Fuselage

Longerons and struts 1/8" square spruce nailed and glued together.

Covering is of bamboo paper, is doped and afterwards painted Fokker style.

Shock absorbing tail skid is used.

Cowls are of sheet aluminum.

Sockets for attaching landing gear to fuselage are light aluminum tubing.

Forward part of fuselage including cowling is painted dark blue. Rear is painted aluminum color.

Empennage

All tail surfaces are constructed of 1/8" x 1/32 spruce and 1/16" diameter reed.

All controls are balanced. Bamboo paper used for covering.

Whole empennage is doped and painted aluminum color.

Landing Gear

Small streamline struts are arranged as on the real machine, four struts on each side. Each "W" strut weights .01 ounce.

Wheels are 2" diameter.

Shock absorbers are used. Cross wiring in both front and rear bays.

Attachment to fuselage by means of aluminum sockets.

Propeller and Motor

Propeller 12" diameter mahogany.

36 feet 3/16" flat rubber is used for motive power.

200 turns of propeller flies the model about 100 feet.

Motor stick of 3/4" x 5/16" spruce.

A ball bearing propeller shaft is used.

Wing

The wing section at fuselage is the "Gottingen" No. 387; at tip, "Gottingen" No. 436. Wing tapers both ways. Chord at fuselage, 6.5"; at tip, 4.375". Two center ribs are located over the longerons. They are of 1/8" balsa, lightened. 14 ribs are used. The center rib on each side of the fuselage, between the centerline of the machine and the tip, is of 1/28" Spanish cedar veneer, lightened. The rest are 1/45" Spanish cedar veneer, lightened. The tip rib is faired with Balsa, thusly obtaining a rounded wing tip.

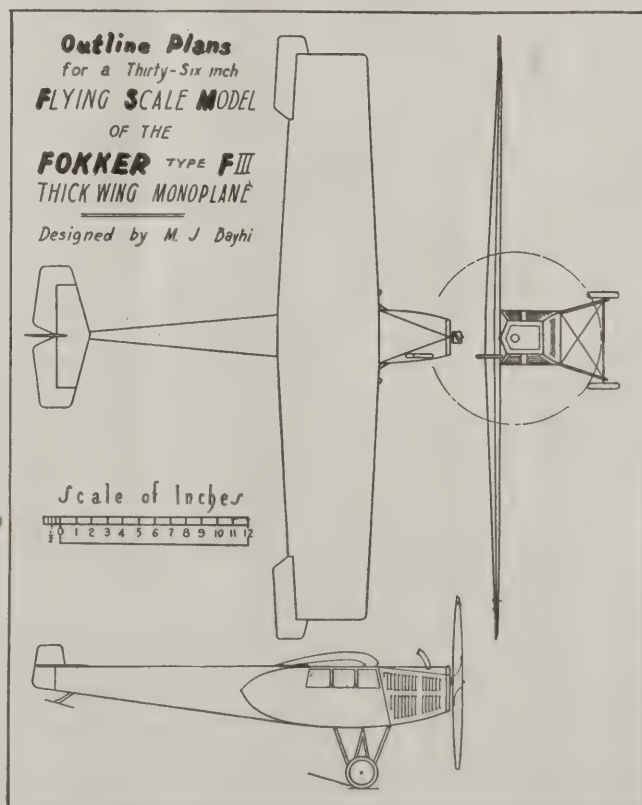
Regular balanced Fokker ailerons are used.

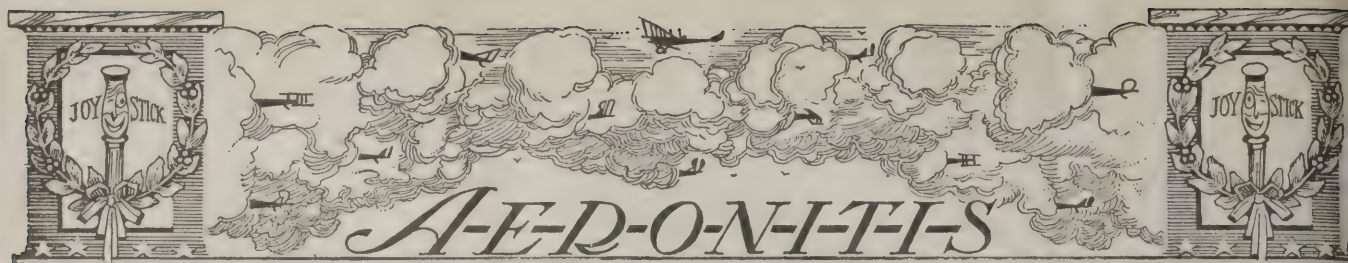
Wing spars are of 1/8" square spruce. Notches are cut in the ribs to receive the spars. Two spars are used; that is, one rear and one front. Both rear and front spars are constructed of two pieces. The total aileron weighs 2.3 ounces. Covered and with ailerons.

Mr. Bayhi has had good opportunities for studying the Fokker machines demonstrated by the Netherlands Aircraft Company. These machines make frequent flights at the Curtiss flying field near Mineola. Mr. Bayhi has made trips as a passenger with Bert Acosta, giving him an intimate knowledge of the flying qualities of the Fokker F III.

A later issue of AERIAL AGE will contain a photograph of this model in flight, showing its remarkable resemblance to the real Fokker monoplane.

Extensive flying tests have not been made of this model, but in the preliminary demonstrations the performance proved its correct design and balance. The propeller was given only 200 turns, and with this power the model took off the ground in a run of about five or six feet, quickly rose to a height of about six feet, descending gracefully in a glide to a point 100 feet from the starting place. The horizontal speed of the model was judged to be rather high, and later tests are to be made in an effort to increase the distance and duration flown by (1) reducing the quantity of elastic motive power, (making more possible revolutions of the propeller); (2) setting the wing at an incidence angle of one degree; (to obtain more lift) and (3) replacing the present propeller by one designed with a view to less speed and more efficient thrust. A later issue of AERIAL AGE will contain a photographic illustration of the model in flight, showing the remarkable resemblance to the real Fokker monoplane.





The Aeronautis

She was shaped like a huge cigar,
Five thousand feet long her keel,
She was built of light metal,
Stronger than the toughest steel.
* * *

Her diameter in the center,
Was three hundred feet through.
Tapered to almost naught at ends.
Only ninety was her crew.
* * *

Her windows were made of malleable glass,
Clear as crystal one inch thick.
She had large libraries & lecture halls,
And a large hospital for the sick.
* * *

Slowly the monster airship rose,
To circle the earth in a day.
At a mile from earth she stood still,
In the busy aerial way.
* * *

For an hour we lay up there,
To take more passengers aboard.
They came to a floating dock,
By air in a veritable horde.
* * *

This huge floating dock of the air,
Now stood by our side,
When we had all her passengers,
Slowly away it did glide.
* * *

Thousands of airships passed us by,
Some were large and others small.
There were business and pleasure ships,
Some shot fast and some did crawl.
* * *

The huge doors were now all closed,
We shot straight up in space.
The ship was now airtight all round,
The crew all in their place.
* * *

At fifty miles from the earth,
We first traveled forward.
At a thousand miles per hour,
The huge ship gracefully soared.
* * *

We scarce knew we sailed at all,
Fifty miles from the earth.
The salons and spacious ball rooms,
Were ringing with music and mirth.
* * *

There was no roar of whirling props,
There were no props or engines beat.
There was no grind of huge machines,
To give the monster ship her speed.
* * *

Of oxygen there was plenty,
Twas stored in bins like salt.
Apparatus turned it back to air,
As need arose without a fault.
* * *

With fine solar instruments,
Heat vibrations from the sun
Were taken direct from the ether,
And kept all from the cold undone.
* * *

We seen huge freighters of the air,
Glide swiftly past our view.
Controlled completely from the earth,
Without a soul aboard they flew.
* * *

The crew knew through instruments,
When another ship drew near.
Automatically ships were kept apart,
All ships of ships always ran clear.
* * *

At night the glitterings in the sky,
Were the most glorious sights.

Not seen from earth in their grandeur,
Were the playing northern lights.
* * *

Most people flew for health and pleasure,
Around the world in this great girth.
By wireless always kept aware,
Of all doings on the earth.
* * *

The ship was run by vibrators,
Sending out vibrations together.
Which were repelled by opposites,
Thus driving the ship through the ether.
* * *

Thus also was the huge ship raised,
Lowered or turned about at will.
Going backward as well forward,
Or in midair stand stock still.
* * *

Through what looked like glowing bulbs,
These vibrations were outward sent.
From nine above and nine below,
Nine on each side one at each end.
* * *

The wise with the low brows said,
What a fool's imagination.
'T is all a dream a wild-eyed dream.
Impossible of creation.
* * *

As 'twas said of the steamboat,
Wireless and the modern aeroplanes.
The grafophone and automobile,
Electric lights, locomotives and trains.

H. Theo. Haller

The Seaplane

Ye earth-bound mortals, frail and weak,
Be still and hear the Seaplane speak:

"A fair, young god just born, am I,
And I cleave the heavens as eagles fly;
My gray sides shimmer in the sun,
My taut wires sing as the race we run.
Upward, yet higher and higher I spring,
Swift as swallow with lightning wing,
Straight to the face of God.

The sea-gull swerves to give me room
And screams aloud as he hears the boom
And roar and hum of my mighty heart,
As hither and yon in the clouds I dart,
Playing "I-Spy" with the sun's bright beam
That wraps me round in a golden sheen—
A shield from the earthly sod.

I dip, I rise like the waves of the sea,
The mother whose bosom has nurtured me.
And ever and ever I feel a thrill
Of joy as I go at my master's will.
The winds beat against my golden wings;
As I dash in their teeth my soul it sings,
And I turn, and I twist, and I roll.

I scorn those weaklings caged on earth,
Of mortal soul and mortal birth;
Above, I soar, in realms sublime.
Kissed at birth by gods divine,
A god I live, a god I'll die,
For I fly to live and live to fly.
A Seaplane, I, with a god's young soul."

Julia Baker.

A Ham Joke

He—I live in my Mary's eyes.
Him—Yes, I noticed she had a sty in them.—Lord Jeff.

AERIAL AGE

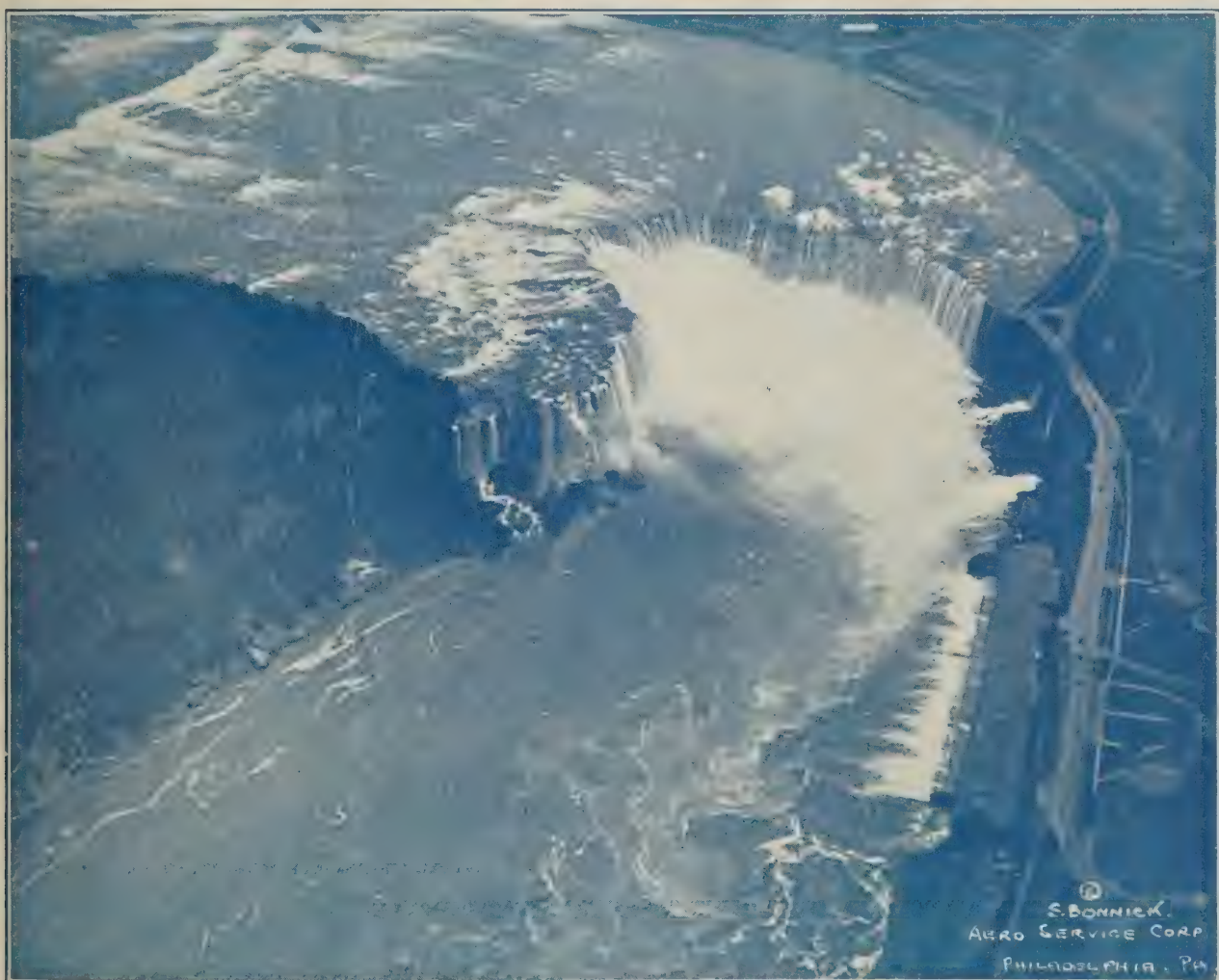
WEEKLY

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APRIL 17, 1922

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A close up view of the Horseshoe Falls, Niagara. On the left is Goat Island, on the right one of the Canadian Power Plants. ©Aero Service Corporation, Philadelphia.

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No. 6

An Air Force Academy Suggested

CREATION of a United States Aeronautical Academy, to be to the air service what West Point is to the army and Annapolis to the navy, is contemplated in a resolution introduced April 3rd by Senator Walsh of Massachusetts. The resolution directs the Secretaries of War and the Navy to investigate and report to Congress on the advisability of establishing such institution.

"Immediate and adequate development of the science of aeronautics," said Mr. Walsh, "is vital to the protection and prosperity of the country. Aviation is now recognized as a dominant factor in relation to future transportation as well as to the national defense. It is a matter we cannot permit to sleep.

"As the Conference for the Limitation of Armament took no action to reduce, limit or control aviation, so far as its use in war is concerned, it should be apparent to the most casual observer that a sufficient and properly trained personnel, capable of developing, instructing and directing the aviation activities of the nation is important.

"If this country is not to be outdistanced in the field of aeronautics and thereby left defenseless, a separate school of aeronautics supported and controlled by the Government should be established."

Senator Walsh suggested that a part of West Point or of Annapolis or some navy yard be used for the Academy.

It is to be hoped that Senator Walsh's suggestion will have the attention which it merits.

A Saga by Wireless

IN their little skiffs the Norse vikings roamed the polar seas, and Scandinavian bards related their exploits in sagas. That was the style of reporting in those days. Now Roald Amundsen, twentieth century viking, equally at home in the cellar and on the roof of the world, expects to float to the North Pole in the good ship Maud, with casual side hops in a metal aeroplane, and he will send daily bulletins of all the Arctic news by radio. Sagas by wireless! It's the modern way.

Most polar expeditions are described as "dashes." Amundsen's trip will be more leisurely. The ice pack on which he is to drift has much to learn about rapid transit. Its timetable promises to deliver the explorer at the pole in three or may be five years. Yet he says there is enough of interest in the million square miles of uncharted surface to keep the ten members of the expedition busy every waking moment. He has high hopes of enriching the store of scientific knowledge and in particular of solving the mystery of the aurora borealis.

Of major interest in the enterprise is the auxiliary use of the aeroplane. It will be the first real test of the feasibility of aerial reconnaissance in the Arctic regions.

—Editorial in N. Y. Tribune.

Aviation—First Line in War

AVIATION has taken a sudden jump to the front as a recognized and invaluable agency in war. When the British government, which has always, and very rightly, in the past considered its navy as the first line of national defense voluntarily renounces this theory and admits that the conditions in 1922 have forced the conclusion that air forces have displaced both the army and navy as the dominating element in the protection of the British Empire we may well take notice—conservatism in the United States must awake from its stupor, and permit intelligence to control our military and naval policies.

Admiral Fisher and Sir Percy Scott, of the British navy, long ago foretold the reign of air power in war, but their warnings were little heeded by the controlling minds in the House of Commons until recently, when Austen Chamberlain raised the question in debate as to "what extent developments in aviation may render naval warfare more obsolete."

Mr. Chamberlain said "he could imagine circumstances might soon lead the world to believe that limitation of battleships or armaments would be of little use unless similar limitation was placed on air craft. . . . Believing as the government did, that the air force had immense potentialities, quite distinct from its duties as an adjunct to the naval and military service, and convinced that in the future the greatest danger to Great Britain might well be from an action by air forces, the government considered it would be a retrograde step to abolish the air ministry and reabsorb the air force into the Admiralty and War Office."

In conclusion Mr. Chamberlain declared: "In case of air raids the army and navy must play a secondary role, but in case of military or naval operations the air force must be in strict subordination to the general or admiral in supreme command."

These astonishing admissions on the part of the British government are justified—in fact, their soundness is conclusively demonstrated by recent happenings. It will be recalled that the Spaniards have used bombing planes to dislodge and demoralize the Moors when other weapons failed, thus saving their battalions from decimation by frontal attacks against a determined enemy. General Smuts employed bombing planes with similar effect against the rebels in South Africa, who were quite unprepared and helpless against this form of attack.

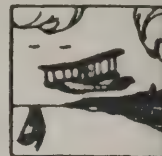
And now we are informed that "the possibility of effectively controlling a troublesome country by means of an 'air army' is to be thoroughly tried out by the British in Mesopotamia."

Winston Churchill has taken the lead in this enterprise. "A fleet of 150 troop-carrying planes is under construction, each capable of carrying ten soldiers fully equipped, together with two machine guns and ammunition. By this means a complete battalion of 1,000 men can be transported hundreds of

(Concluded on page 142)



THE NEWS OF THE WEEK



U. S. S. Langley Commissioned as Airplane Carrier

Norfolk, Va.—The U. S. S. Langley, airplane carrier, has been commissioned at the Norfolk Navy Yard. The ship was turned over to the Navy by the Navy Yard, and Commander Kenneth Whiting has assumed command of the vessel until her commander shall have been appointed. Commander Whiting will remain on board the ship as executive officer at all times, however.

Commander G. de C. Chevalier, U. S. N., will be given complete charge over all aviation activities aboard the vessel. He will come under the captain and executive officers, but he will have entire command of all the movements of the aviators and their craft, on the ship.

The commissioning of the ship was ceremonious, since the *Langley* is the first of her kind to be commissioned in the United States Navy.

Several hundred men, including architects and mechanics of nearly all the trades, have been employed in making the former collier *Jupiter* a complete airplane station afloat. Incident to her being a "harbor" for aircraft, the *Langley* will be one of the most peculiar looking ships on the seas. The thing in her build, which makes her radically different from other ships, is her landing deck. That deck is an immense platform, mounted above her main deck on trussed towers. Only by standing on that great platform can its proportions be appreciated. One is impressed with the feeling of standing on a field, so large is the deck.

Deep down in her hold has been stored quantities of chain and concrete, which will serve as ballast. Above this invaluable "cargo" and in the forward part of the vessel will be installed a complete shop for the repair of all kinds of aircraft. With the proposed machinery in her hold, and a capable crew, it will be possible to construct a plane almost completely aboard the vessel.

The *Langley* is 525 feet long and 65 feet beam, and she is driven by motors with a total horsepower of 5,500. She is said to attain a speed of 14 knots. The ship was built at Mare Island Navy Yard in 1912. Later, when the value of a ship of the type she now is was realized, the Navy Department turned the vessel, then a collier, over to the Navy Yard here, where she has undergone building changes for two years. The ship, although commissioned, is not completed. More months must elapse before she can steam out on her trial trip.

During the World War, aviation made a remarkable advance. In naval circles especially has the value of aircraft been realized. A home had to be provided for the "wasps," and it fell to the lot of the *Jupiter* to be converted.

Her name was changed to honor a pioneer of aviation, Langley, the man who was laughed to ridicule and whom Congress refused to grant money for the perfection of his airplane models because they were "impractical." He is now to be immortalized by a ship on the seas.

The ship is not quite completed. Before she will be ready for service her equipment must be installed. That one word "equipment" will include the only complete aviation repair and construction shop afloat.

Other additions to the strange vessel will be made in due time and all work is expected to be completed by May 1.

Flying Club of St. Louis

The Flying Club of St. Louis has established a flying field and club house eight miles from the city limits on the Natural Bridge Road. This field is northwest of St. Louis and situated on the Wabash Railroad at Anglum, Mo. It can be distinguished from the air principally by the hangar and a large grain elevator. No charge is made for the use of the field and space for hangars is provided free of charge.

The club is planning to organize a reserve unit for both lighter and heavier than air, and will cooperate with Scott Field, where at present the Air Service is constructing a large steel hangar for dirigibles.

The Advisory Board of the Flying Club is as follows: Albert B. Lambert, Chairman; Sam D. Capen, L. D. Dozier, F. W. A. Vesper, Ed. T. Hall, Frank C. Rand, Fred H. Semple, Col. A. T. Perkins, Harry B. Wallace, Robt. T. Morton, James M. Hranciscus, W. C. D'Arcy, Jesse McDonauld, Geo. P. Dorris, M. W. Hayes.

Personal Par

M. A. C. Johnson, of Akron and Troy C. Williams, of Augusta, are barnstorming Georgia, North and South Carolina in a Standard-Curtiss.

W. B. A. C. Progress

The World's Board of Aeronautical Commissioners is making rapid strides in its membership campaign in the United States. There are 1937 nominated for membership, 2884 counties out of 3048 are represented by acceptances of state nominees, and 8088 cities and towns represented by acceptances of county nominees. Ninety-four countries and colonies are now represented by 111 commissioners.

Plan Airship Service England to Australia

London—A proposal for the formation of a company with a capital of £4,000,000 to start a mail and passenger airship service between England, India and Australia has been laid before the Government.

A powerful financial syndicate has offered to take over the British airship fleet which was due to be consigned to the Disposal Board. No capital investment by the Government is required, but there is a contingent liability in the form of a guarantee of interest and dividends of £91,000 a year from the State.

Messrs. Vickers, Limited have undertaken to subscribe for 100,000 shares at par and the Shell groups for 100,000 ordinary shares or debentures at par. Both companies will give full technical assistance.

The total contingent yearly subsidy in the form of a guarantee of a dividend on the ordinary shares and interest on the debentures (on the capital now proposed to be issued) would be on £1,200,000 ordinary shares, £72,000 for ten years. On £2,200,000 debentures, £990,000 until redemption. Dividing the subsidy among the countries which would obtain the benefit of airship service the cost would be: Britain, £91,000 a year; Australia, £40,000 a year, and India, £40,000 a year. These dividend and interest payments would cease as soon as profits from the company were sufficient to pay them.

The program of development has been divided into two stages—a bi-weekly service to India and an alternate day service to India with weekly extension to Aus-

tralia.

The Government is asked to transfer to the company free of cost all airships, airship material and airship bases and supply wireless telegraphy and meteorological services.

If the scheme is approved, it is claimed the airship passengers from England would reach Bombay in five and a half days, Rangoon in seven and a half days, Hongkong in eight and a half days and Australia in eleven and a half days.

The new ships will be capable of carrying a hundred passengers and eight to ten tons of mail, and will have a cruising speed of sixty miles an hour.

Attacks Navy Air Exams.

Washington—Senator Walsh told the Senate Naval Affairs Committee on April 6 that "unjust examinations" are driving 500 Naval Reserve airmen, among them some of the best in the service, back into private life. The Massachusetts Senator suggested that the committee ask the Navy Department to correct what he described as "a deplorable situation." Some of the most efficient and experienced air officers were being forced out, the Senator said, by "trick" examinations.

"These men are trained in the science of aviation over a period of years and then called upon to pass examinations involving navigation, steam engineering and other subjects with which they, in the very nature of their work, are not familiar," the Senator continued.

"I will show that there is discrimination in the navy between the boy from the ranks who wins his commission through hard work and on his merits and the boy who goes through Annapolis. The aviation arm is one that cannot be trifled with in any efficiently organized modern navy."

Efforts of certain old-time officers who, he said, were opposed to the naval aviation program were another handicap to proper development of navy aviation, said Senator Walsh.

COMING AERONAUTICAL EVENTS

AMERICAN

Apr. 30.—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.

May —National Balloon Race.
Sept. 4.—Detroit Aerial Water (about) Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)

Sept. 15.—Detroit Aerial Derby, (about) Detroit. (Pulitzer Trophy Race.)

Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

Aug. 1.—Coupe Jacques Schneider. (about) (Seaplane speed race.) Italy, probably Venice.

Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.

Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

The AIRCRAFT TRADE REVIEW

Detroit-Cleveland Airline

Eddie Stinson, holder of the world's endurance record, who recently purchased a number of Junkers monoplanes from the Government, is now in Detroit having the machines overhauled at the Stout Engineering Laboratories, and when the changes have been completed a line will be established between Detroit and Cleveland. It is planned to make eight trips a day.

Stinson is having one machine especially kitted for long distance work, and this summer he will attempt a non-stop flight from San Francisco to New York, and he is thoroughly confident he will be successful. Stinson is one of the most experienced fliers in America, and his many friends throughout the country are congratulating him on his new enterprise and wishing for him the utmost success.

Curtiss Employees Fly to Keep in Practice

Through the efforts of Mr. Theodore Wright, Executive Engineer of the Curtiss Aeroplane and Motor Corporation, Garden City, employees of the company who were formerly pilots, are allowed the use of a JN aeroplane for practice flights.

Mr. Wright, who was a naval flying officer, and several other members of the engineering department formerly in the flying service, are able to keep up their practice by this arrangement with the Curtiss officials.

Pilot C. S. (Casey) Jones is supervisor of flights, which are now made on Saturday afternoons, Sundays and holidays, but with the coming of "daylight saving" time, opportunity will be had for flights in the early evening. At present, the pilots now eligible for practice flying are: Theodore Wright, C. A. Koch, S. Joseph, E. E. Tattersfield, V. Higbie and John H. De Mott. Mr. H. Ogden, employed in the engineering department, is progressing rapidly in the art of flying, under the instruction of "Casey" Jones.

The Curtiss Company recognizes the value of trained flyers in its organization and encourages their work in a practical manner.

Personal Par

Mr. Grover C. Loening, President of the Loening Aeronautical Engineering Corporation was recently operated on for appendicitis at the Knickerbocker Hospital

by Doctor D. W. Martin, Chief Surgeon of St. Luke's Hospital.

The attack was very sudden, but the operation was entirely successful. Mr. Loening has now left the hospital and is expected to be back at his work in a week or ten days.

Wallace Field News

A busy season is looked for at Wallace Field. An innovation there this year will be an Airplane Filling Station, where filtered high test gas will be supplied to flyers from a ten-barrel underground tank, with pump rigged high enough for its 16-foot hose to reach the gas tanks of any ships and fill them almost instantaneously.

J. Wesley Smith has joined Frank Wallace's corps of flyers, and companies operating from the field will include:

The Carlson Aviation Company.
The Aircraft Service and Sales Company.

The Fred Brown Repair Company.

Wallace Field is registered, contains 103 acres, and is open to the use of all flyers. It is located on the Mississippi, just above Davenport—a "town with eyes on the top of its head."

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, February 1922

DIVISION	Gas	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchman	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
														Gallons of Gas	Total Time Run Hr., Min.	Total Miles Run	Cost per Hour	Cost per Mile
EASTERN New York- Chicago.....	\$3,190.91	\$588.82	\$4,060.87	\$2,841.43	\$842.89	\$1,120.20	\$3,301.38	\$1,488.74	\$4,189.31	\$2,944.61	\$1,709.19	\$784.78	\$27,063.13	10,649	384 30	36,341	\$70.38	\$0.74
CENTRAL Chicago- St. Louis.....	4,140.48	890.95	3,708.49	2,209.54	808.10	1,151.95	3,574.72	2,156.10	5,389.80	4,994.79	2,475.37	1,136.58	32,636.87	14,982	576 11	52,101	56.66	.63
WESTERN St. Louis- San Francisco	2,668.15	469.82	5,873.29	1,663.24	1,105.94	690.44	3,549.69	1,488.74	3,759.66	3,435.35	1,709.19	784.78	27,198.29	8,712	314 17	29,642	86.54	.92
Islands and Territories.....	\$9,999.54	\$1,949.59	\$13,642.65	\$6,714.21	\$2,756.93	\$2,962.59	\$10,425.79	\$5,133.58	\$13,338.77	\$11,374.75	\$5,893.75	\$2,706.14	\$86,898.29	34,343	1,274 58	118,084	\$68.15	\$0.74

Total Operating Cost.....\$86,898.29
Permanent Improvements..... 4,658.59
Grand Total.....\$91,556.88

COST PER MILE			
Division	Overhead	Flying	Maintenance
Eastern.....	\$0.21	\$0.22	\$0.31
Central.....	.18	.20	.25
Western.....	.27	.23	.42
Entire Service.....	\$0.21	\$0.22	\$0.31

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio.
Flying consists of: Gas; Grease and Oil; Pilots.
Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories; Warehouse.

E.R. WHITE, Acting Second Assistant Postmaster General.

AERONAUTIC CHARTS

By STORY B. LADD

THE chart is for the guidance of aviators, so that an operator can lay his course direct for his objective point and can, en route, check and correct his course for air drift.

The underlying principal is the subdivision of the continental areas into blocks, and the installation of markers at the intersection of block lines which, by reason of their shape, contour, or distinguishing features, as viewed from above, will indicate to the observer the geographic position of the marker.

It is not proposed to post the entire country, nor any portion thereof, by the installation of markers at all points, but to provide a system which can be added to or differentiated as the growth of air travel requires, and whenever or wherever a marker is installed, whether under national or state auspices, by Aero Clubs, Chambers of Commerce, or other organizations, it will be in harmony with the general plan, and become a part of the continental system.

The blocks are spherical quadrilaterals, laid out on lines of latitude and longitude, and the term as here used refers to an area bounded on the east and west by north and south lines, and on the north and south by east and west lines; by meridians of longitude and parallels of latitude, respectively.

The term "marker" refers to a device or structure, preferably erected so as to stand above other objects in the neighborhood and be distinguishable at a distance.

It is important that the system, in its growth and development, be continental in its scope, without breaks at national or state boundaries, and that all markers, wherever installed, shall be alike in character and significance, and speak the same language to the aviator. In this presentation it is described as applicable to a world system.

Eight degrees, of longitude and latitude, has been taken for the major blocks, these to be subdivided into quarter sections, and the quarter sections into quarter blocks,

giving, as a result, 16 quadrilaterals, 2° by 2° , these being referred to as intermediate blocks. These intermediate blocks are in like manner subdivided into quadrilaterals of $24'$ by $24'$ making 25 subdivisions. These are the minor block units, and each marker that is installed identifies a minor block.

With major blocks of 8° standard for all countries, the major blocks in the equatorial zone will be approximately 550 miles square with intermediates ($2^\circ \times 2^\circ$) of 138 miles, and minor blocks ($24' \times 24'$) of 27.6 miles. Going north and south from the equator, the distances along meridional lines will be constant, with the distances along parallels of latitude gradually diminishing. At the 40th parallel, the east and west dimension for the major blocks will be approximately 428 miles; for intermediates, 107 miles; and for minor blocks, 21.4 miles. At the 50th parallel of latitude, these distances will be approximately 360 miles, 90 miles, and 18 miles, respectively; and at 60° , 280 miles, 70 miles, and 14 miles.

The subdivisions of the intermediate blocks may be 36 in number, 6 in a tier, each $20' \times 20'$, or even 64 in number, 8 in a tier, each $15' \times 15'$, if the markers on the basis here outlined are too far apart, but it is thought provision for shorter intervals, when desirable, can be best met by mid-block markers at half intervals.

For purposes of identification, the intermediate blocks are lettered *A* to *P*, beginning at the northwest corner of a major block and in quarter section groups, the letters *A*, *B*, *C*, and *D* indicating the four intermediate blocks of the northwest quarter section; *E*, *F*, *G*, and *H* those of the northeast quarter section; *I*, *J*, *K*, and *L* the southwest quarter section; and *M*, *N*, *O*, and *P* the southeast.

The major blocks are to be cited by the longitude and latitude of the northwest corner of the block, and as all major blocks are 8° in dimensions these numbers are

always multiples of 8, longitude being placed first. Thus "104-48" identifies a block bounded by meridians 98° and 104° (in the western hemisphere) and by parallels of latitude 40° and 48° (in the northern hemisphere); and "104-32" identifies the major block covering southern Texas and a portion of Mexico. If there is any question as to the quarter of the globe, designating letters will precede the numbers. In this event, the above noted blocks will be designated "N. W. 104-48" and "N. W. 104-32." "N. E. 40-48" is a block covering parts of Southern Russia and the Caucasus; "S. E. 16-24" (still using the northwest corner for blocks in the southern hemisphere) the South African Union; and "S. W. 64-32" portions of Argentina and Uruguay.

The letter designation of the intermediate block follows the major block designation—thus "N. W. 104-48 C" indicates the intermediate block *C* in a major block, the northwest corner of which is 104° west longitude, and 48° north latitude.

The minor blocks are identified by numbers 1 to 25, beginning at the northwest corner of the intermediate block. These are the marker numbers. In designating a minor block, the number follows the intermediate block letter, thus "104-48 C 10" identifies a specific location (the marker may or may not have been installed) in block "104-48 C."

Markers.—The markers are platform structures, carried by skeleton towers, high enough to clear surrounding objects, and in forest and timbered districts to show above the trees. In open country an elevation sufficient to be out of the way of cattle and drifting snows will suffice.

In mountain or broken country where the true location of a marker comes in a ravine or valley, or where it would not be visible from a distance, it will be located at the nearest available point, the offset showing on the charts.

The contour of the platform is the dis-



Aeronautic Charts—Block System

1) See "Aerial Age", of Aug. 22, 1921 and Dec. 26, 1921.

inctive feature of a marker that identifies the intermediate block in which it is located, and it is desirable that the distinctive shapes be as few and simple as possible. To this end the shapes recommended are four in number, circular, square, triangular, and a trefoil. In this connection, the effect of foreshortening is to be borne in mind, a circle appearing as an ellipse and a square as a diamond or a rectangle. All markers within an intermediate block are to be of the same contour. The shape of the platform as viewed from above identifies the intermediate block, and the four shapes suffice for the four intermediates that form a quarter section of a major block.

It is necessary that the visibility of the markers be preserved under snow conditions when the ground and the platforms are white with snow. For this purpose the platforms are made with a skirt around the outer rim, sloping outward at a steep angle and painted black. From above this rim skirt will appear as a black line outlining the edge of the marker. Snow may adhere hereto to some extent on the windward side, after a storm, but sufficient portions will be exposed to catch the eye of the aviator.

The quarter section is preferably to be indicated by an adjunct that will not confuse the platform contour, but which can be readily interpreted, and in a prior presentation of the project the markers were to be provided with an arm projecting to the northwest, the northeast, the southwest or the southeast, as the case might be. An arm extending out from the rim of the marker will detract from the distinctiveness of the contour and may be confusing to the observer, and moreover he might be in doubt as to the compass direction in which the arm was pointing. It is therefore proposed that the quarter section be indicated by one or more discs, separate and detached from the marker platform, but carried by the platform structure on a level with the platform. The position of these discs with respect to the platform is not material; but for uniformity and in order that an aviator may know where to look for them, they are on the south side of the platform. They may be truncated cones, with black slopes, far enough removed from the platform so that under snow conditions the space between a disc and the platform will not be bridged by the snow and the outline of the platform broken. One disc will signify the first or northwest quarter of the major block, two discs the second or northeast quarter, three the southwest quarter, and four the southeast quarter. The scheme may prove one for one, two, or three discs, for the second, third, and fourth quarters respectively, the absence of a disc signifying the first quarter. In the event, however, an aviator not noting the presence of a disc or discs, he would interpret the marker as being in the first quarter; whereas if all markers carry a disc or discs, he will always look therefor and will miss the correct interpretation.

The combination of the four contours and the discs provides for the ready identification of any one of the 16 intermediate blocks without recourse on the part of the observer to compass directions.

With respect to the major blocks, which represent areas of 200,000 to 300,000 square miles, it is assumed that no marker feature is necessary. An aviator will know his position as between eastern Massachusetts or Ohio, Central Illinois or southern Alabama, the north of France or Spain. With knowledge of the marker shape and the number of accompanying discs, which will appear as dots or spots contiguous to the platform, he at once knows his position within 2 degrees.

The minor block units are indicated by numbers from 1 to 25, showing in the center of the markers. The number is placed to be read from the south and appears separate and detached from the surrounding platform in the middle of an open central field. The space between the number and the edge of the surrounding platform will be sufficient, in northern districts, to bar the formation of a snow bridge. To maintain the visibility of the numbers under snow conditions, they can be made of hipped lines of steep slopes, and painted black. Though in winter, in some districts, a marker may carry a heavy snow blanket, there will be open space around the number and the lines will be sufficiently exposed to be decipherable. An aviator may not be able to read the number from a considerable elevation or distance, but if knowledge of the intermediate block from the marker contour is not sufficient, he will approach near enough to decipher the number.

At the distances between markers called for by the foregoing, an aviator, when following a posted route, will pass beyond view of a rear marker before he catches a glimpse of the one ahead. Under normal conditions a marker can probably be seen at a distance of 5 or 6 miles. But he will come within view of the forward marker before he can have materially deviated from his course. In a cross flight, however, he may cross a posted line at a midway point and out of sight of a marker. It may therefore be desirable to install markers at such intervals that in a cross flight a marker will be within range of view regardless of where the poster route is crossed. It is proposed to meet this requirement when necessary, by intermediate markers located on the line midway of the minor block corners. They can carry the distinguishing features of contour and disc or discs, called for by the block, and if more exact information is desirable the number with the addition of a short "dash" after the number within the central open field, if the marker is on an east and west line, or below the number, within the central open field, if the marker is on a north and south line. Thus twelve will signify that the marker is located at a half-way point between locations "12" and "13" of the intermediate block, and twelve that the marker is located at a half-way point between locations "12" and "17" of the intermediate block—"7" being the minor block south of "12." It will probably, however, be sufficient for the marker to show only the block contour, for if more exact information is desired the aviator will turn aside and look for the next marker on the line.

Inside markers. A marker located within the confines of a minor block, for ex-

ample in proximity to a landing field, can show the indicia called for by that minor block with the addition of an inside ring around the number and a narrow annular open space between the ring and the platform. This will signify that the marker is within the area of the block, the position of same being shown on the chart for that district.

Frontiers. At the frontier crossing on a postal route, the boundary line can be marked by a split platform of the contour called for by the intermediate block but without the number, the platform being divided by a central gap conforming in direction to the boundary line.

Notice of installations. As installations are made, the locations will be published as items of general news and the aviators will mark the locations on their charts. This publication will call simply for the longitude and latitude designations of the major block, the intermediate block letter, and the minor block number. In the case of a marker that is off the true location, its position will be given by coordinates with respect to the block corner; as, for example, when because of the topography of the country, "104-40 D 8" is erected "2 miles north and 3 miles east" of the northwest corner of said block.

Duplicate markers. If a continental route is posted on an unbroken east and west, or north and south line, there will be a duplication of the markers in the major blocks traversed. For example, if a due east and west transcontinental line is posted from Georgia to California, the series of markers in blocks "80-40," "88-40," "96-40," "104-40," "120-40," and "128-40" will be duplications. This can be avoided, in laying out the line, by offsets between major blocks. If at the junction of "80-40" and "88-40" the line is side-stepped to the next tier of minor blocks, say to the north, it will strike a different series of marker numbers. Then crossing to "96-40" let there be another offset and likewise with each successive block. There will then be no duplications on the entire route. The same course can be followed with respect to north and south posted lines.

Urban and Industrial Districts. A cordoned off of markers surrounding an industrial district will give an aviator his bearings from whatever direction he approaches. Knowing the longitude and latitude of a point within a district, the block locations, and the proper contour, quarter-section designation and numbers are readily determinable.

Direct routes. The posting of direct routes between points can readily be done in the initiation of the project by installing the markers along the lines of travel at the points called for by the system. Many of these will be at varying distances to the right or left of the line but within view, and where the line of travel crosses a block line at a point some distance removed from a block corner, a midline marker can be installed, as above indicated.

Night travel. For night service on a route where there is regular travel, the markers will be equipped with lights under radio control so that an aircraft, with radio control can, at will, cut in the lights within range, and lights will be on only as needed.

SEVENTH CORPS AREA COMMERCIAL AERONAUTICAL ASSOCIATION ORGANIZED

By R. TAYLOR

Special Correspondent of the Aerial Age

THE Commercial Aeronautical Association of the Seventh Army Corps Area, the first of its kind in the United States, was organized by business men of the area and others interested in aviation at the convention in Sioux City, Ia., March 27, 28 and 29. This marks the first organized effort in America toward establishment of a commercial air transportation system, and will be followed by similar action in the other eight corps areas, the intention being to ultimately inaugurate a transcontinental air system.

The constitution of the new organization includes provisions for the development of aeronautics both commercially and scientifically; establishment of uniform landing fields in the fifty-nine leading cities of the area; co-operation with other corps areas in promoting a transcontinental system, and co-operation with the war and navy departments in the matter of aerial defense.

The seventh area organization will seek to become a part of the Aeronautical Association of the United States of America, following perfection of the national association at the convention in Detroit in September.

Support of the air mail service and the early passage of the Wadsworth-Hicks bill was advocated in resolutions passed by the convention.

All cities and towns of the Seventh army corps area, which includes Arkansas, Missouri, Nebraska, Iowa, North Dakota, South Dakota, Minnesota and Kansas, will be invited to become members through their aeronautical clubs or chambers of commerce, according to the tentative agreements made at the convention. The corps area organization also will accept personal memberships at \$5 each. Local organizations must have not fewer than 25 persons in order to gain admittance to the association.

Cities of 10,000 or under would be represented by one vote in the corps organization, and one delegate for each additional 10,000 of population would be added, according to plans of the officers.

It is planned to divide the cities into three classes. First class cities will be those of 50,000 or more in population; second class, between 12,000 and 50,000, and third class, 12,000 or under.

Requirements of first class cities include possession of a first class landing field; hangar facilities for at least six commercial air craft; repair hangars to care for two planes at a time; oil and gas filling stations; identification markers complying with international rules; a field superintendent on duty at all times, and the location of the field to be convenient for surface transportation.

Cities of class two would need hangar facilities for three ships; emergency repair shops; gas and oil supplies; identification markers; wind zones, and telephone and wireless equipment. Cities of the third class would be known as an emergency landing place, and would be required to have a field, the size and type of which would change according to service required.

Assisting the Seventh district delegates in the organization scheme were Rear Admiral W. F. Fullam, former commander of the naval air forces, and Brigadier General W. L. Kenly, former commander of the air forces in France, both acting as advisors.

The use of lighter than air craft for commercial air transportation is a certainty of the future, declared General Kenly in his address to the delegates.

"Because of the Roma and Z R-2 disasters there is no reason why lighter than air craft cannot be developed," said General Kenly. "Lighter than air craft is coming, as sure as life. The public at present knows heavier than air machines, but is not acquainted with dirigible balloons. However, the need of lighter than air craft will be felt in the inauguration of an extensive commercial system.

"This country has practically a monopoly on helium. I believe helium can be produced on a commercial basis and at a comparatively low figure.

"Two years ago, a board of engineers representing the American Investigating Corporation went abroad to probe development of lighter than air machines. After a year of investigation, during which they visited England, France, Germany and Italy, the engineers reported the project was feasible commercially. They found the Germans far ahead of the other countries in the development of lighter than air craft.

"One of the results of this report has been the formation

of the General Air Service. This firm has acquired certain rights on German inventions in the lighter than air machines and now is devoting its attention to the possibilities of commercial helium.

"With helium and properly constructed machines we can travel anywhere with perfect safety. But there also will be further opportunities for heavier than air craft. When the great lighter than air machines are working on established routes, the heavier than air machines could be used to good advantage in forming quick 'feeders.'"

A paper by Samuel S. Bradley, general manager of the Aeronautical Chamber of Commerce, and read by J. B. Harvey, Kansas City delegate, pointed out the growth of aeronautics in the United States in 1921.

"We estimate, from reports received by the Aeronautical Chamber of Commerce, that there was about 20 per cent more flying in the United States in 1921 than during the previous year," said Mr. Bradley's paper. "This is a remarkable fact when one recalls the general business and industrial depression.

"The public has changed its mind in regard to flying. A year ago many persons believed that the present generation, which witnessed the development of the motor car, wireless and other astounding inventions, would not accept the flying machine. It was a bit too much to expect of a race that had always kept one foot on the ground, so to speak. Nevertheless, the aeroplane has been accepted.

"The general opinion prevails throughout the industry that the public has been shown and that it now is up to the public to make use of the flying machine for what it is worth. Then, let us hope to find another 20 per cent increase in flying at the end of this year.

"Half of the aeronautical activities of 1921 were carried on in the region between the Appalachian and the Rocky Mountains. Half the aeroplanes in the country are operated there. The Mississippi, Ohio and Missouri River Valleys, Colorado, Montana, the Dakotas, Iowa, Nebraska, Oklahoma and Texas afford many natural advantages, chief among them, emergency landing facilities. It is estimated that more than 300 planes were entered in flying meets in the Middle West in 1921, and that they flew a total of 500,000 miles in these meets, carrying approximately 15,000 passengers before the crowds aggregating 400,000 spectators.

"Now it is up to us, or rather, to the government, to protect commercial aviation. We must protect people and property, in flight and upon the earth, against damage, loss or nuisance from aircraft. In other words, we must secure adequate control of flight, but in a manner that will not throttle development. The problem is civilian because it pertains to commerce and industry. At the same time it is intimately connected with national defense. The Wadsworth-Hicks bill should be made a law before spring flying opens. With air laws will come capital and individual responsibility."

The science of flying in the future will be so advanced both as regards lighter than air craft and heavier than air machines that there will be intimate and general communication between all cities and towns of the country by means of aircraft, it was predicted in an address by Admiral Fullam.

"This aircraft communication will involve a transportation of mail, passengers, and, to a certain extent, freight, between communities and different sections of the country," said Admiral Fullam. "It is believed, therefore, that the organization of the Commercial Aeronautical Association of the Seventh Army Corps Area in Sioux City is a movement that will ultimately be of great benefit to every town and city that joins in the movement. It is the dawn of a new era in transportation which will benefit all business interests.

"It is clear that in a few years the enormous and expensive battleships of the present day will be so completely at the mercy of air attack, combined with submarine attack and mines and torpedoes that no more ships of this type will be built after the ten-year naval holiday. Of all these new weapons it is believed that the air forces are the most important, for with these alone a nation can absolutely protect itself from naval raids and from invasion by armies overseas.

"No fleet and no convoy can bring with them across the sea sufficient air forces to command the air after they reach our coast, provided this country supplies itself with strong air forces for the use of the army and navy. In this con-

nection commercial aviation, involving the use of both heavier than air and lighter than air machines is of the most vital importance to our country, because all such forces, with their personnel, could be rallied as a reserve in time of war.

"It is my belief that aviation has great practical uses and that safety in flying has been secured to such an extent that we may discount all fear as to the dangers involved. In Europe, men of big interests are flying all over the continent to keep their dinner engagements. Lighter than air craft development will unquestionably be recognized soon as a safe and reliable means of transportation."

THE BELGIAN PLAN OF SUBSIDIES FOR AIR TRANSPORT COMPANIES

Subsidies

SUBSIDIES are of two kinds:

(1) Subsidies based upon the hours of flight and the distance covered.

(2) Commercial efficiency subsidies proportional to the gross receipts.

The subsidies under (1) comprise:

(a) An amortization subsidy;

(b) A course subsidy.

The amortization subsidy is determined by the formula

$P + 1.5 p$ where P represents the value of the cellule (in

francs) and p the value of the engine group (in francs,) each increased by 20 % to include the costs of upkeep and insurance.

The value of the cellule and engine group is fixed by the Technical Commission of the Administration of Civil Aeronautics at the time of the proposal of the Service.

The course subsidy is determined by the formula $\frac{K}{1000} \times V^2$

$\times 1.5 T$, where V represents the speed, T the useful load and K a variable. The speed V is measured in kilometers per hour at 2,000 meters. T is the load in tons after the following have been deducted:

(a) The weight of the crew (computed at 80 kg. per person.)

(b) The weight of the navigation instruments.

(c) The weight of the fuel.

The load factor of the aeroplane must be at least 5.

The practical ceiling (height attained after one hour of flight) must be at least 4,000 meters with full load.

The aeroplane must be able to cover a course of 500 kilometers with a contrary wind of 10 meters per second, admitting that the speed of the aeroplane is its speed at 2,000 meters and that the consumption of the engine is that taken on the ground and at full power.

The value of K is fixed as follows:

Mean length of Course (in kilometers)	200	201 300	301 400	401 500	501 600	601 700
In Belgium.....	3	4	5	7	8	9
International.....	4	5	6			

The number of hours of flight subsidized is calculated by following the itinerary determined at a fixed speed of 130 k. p. h. The course will be measured in a straight line from the point of departure to the point of arrival unless an obligatory itinerary is fixed by international agreements or national rules. In these cases the course will be measured by the broken line which passes through the center of the airway imposed and which avoids the forbidden zone. Journeys will not be subsidized which are not completed or which exceed the normal duration by 50% (normal duration being the quotient obtained by dividing the distance D by the commercial speed of 130 k. p. h.) However, in the case of special atmospheric conditions properly noted and proved, complete journeys made with several stops may be subsidized when they have been made in a length of time showing a gain of at least 25% over the fastest means of public transport on land or sea.

Except in the case of "force majeure" properly noted by the Chief of the Aerodrome or his delegate and of which mention must be made in the log book, a delay in departure of $\frac{1}{4}$ of an hour incurs a reduction of 5% in the time subsidy. The same reduction applies to each $\frac{1}{4}$ hour or fraction thereof which follows.

The time subsidies fixed above can be increased or diminished according to the degree of punctuality attained. A coefficient of variation is established monthly as a function of the regular-

The following officers were elected for the Seventh corps organization: Ralph W. Crum, Davenport, Ia., president; M. F. Stack, St. Louis, first vice-president; J. B. Harvey, Kansas City, second vice-president; W. B. Swaney, Fort Dodge, Ia., third vice-president; John W. Coleman, Sioux City, secretary, and C. H. Wolfley, St. Joseph, Mo., treasurer. The board of directors will consist of the officers and E. R. Schultz, Sioux City; J. L. McNeill, Des Moines, and A. R. Dunphy, Omaha.

The office of the secretary, John W. Coleman, is located at 315 Metropolitan Building, Sioux City.

ity of service. The regularity is defined by the proportion of the number of journeys subsidized to the number planned (extra authorized trips being excluded.) The coefficient of variation will be equal to the above proportion expressed in hundredths, increased for the months of December to March inclusive by 35/100 and for the other months by 25/100. The monthly total of the time subsidies to be paid is then multiplied by this coefficient, thus giving the net sum to be paid.

The amount of the commercial efficiency subsidies is in direct relation to the reduction made in the fares, and varies according to whether it concerns passenger or freight.

(a) *Subsidy for passengers.*

To benefit by this subsidy the passenger fare must not exceed 1.25 fr. per km. This subsidy is given according to the following method:

For all reductions of less than 10% from the fare of 1.25 fr. per km. a subsidy of 60% on the receipts is given.

For reductions of 10% to 19% inclusive, from 20% to 29%, from 30% to 39% and for 40% or more, subsidies of 90%, 120%, 150% and 180% respectively, are given on the receipts.

(b) *Freight subsidy.*

To receive this subsidy the charges for freight transport must not exceed 0.02 francs per kilogram per kilometer. The subsidy is calculated as follows:

Every reductions of less than 20% from the cost of 0.02 francs per kilogram per kilometer gives the right to a subsidy of 35% of the receipts.

Reductions of 20% to 29% inclusive, 30% to 39%, 40% to 49% and 50% or more are compensated by subsidies of 60%, 85%, 110% and 135%, respectively, of the receipts.

Conditions Required to Obtain Subsidies

(a) The Company must be Belgian.

(b) The capital of the Company must be at least equal to the amount of the annual subsidy which it will receive, supposing that all the journeys proposed are covered and taking into account only the time subsidy.

The capital will be represented either by buildings or material (the value of aeroplanes being that fixed by the Administration of Civil Aeronautics,) or by supplies or hangars (intended only for the proposed lines,) or by subscriptions of which the total payment may be required by the State.

The origin of the capital, all necessary information in regard to the shareholders and the names of the directors must be communicated to the Administration of Civil Aeronautics at the time of formation of the Company or on any change in it.

(c) The personnel directing the Company must be of Belgian nationality.

(d) The pilots and mechanics are to be in general of Belgian nationality. The employment of foreign pilots and mechanics will be authorized only in case of lack of Belgian personnel.

(e) The aeroplanes used must possess their navigation certificates and Belgian licenses.

(f) The pilots must be provided with the Belgian licenses as pilots for aeroplanes for public transport.

(g) The services which the Company proposes to effect must be of public or national interest and offer a great improvement over existing means of transport.

(h) In general no Company will be subsidized which does not maintain a daily service over Belgian territory or to foreign points if within 250 km. of the Belgian frontier. In the case of more distant points the service must be at least three times per week.

(i) The fares must be agreed to by the State.

(j) In case the Company should use private landing fields they must be acceptable to the Administration of Civil Aeronautics.

Obligations

The State requires a minimum number of aeroplanes, pilots and mechanics in the interests of regularity and safety of the services.

The required minima are:

1. For aeroplanes. Twice the number of aeroplanes which will be used up during the operation of the service. The number is calculated by taking the life of the aeroplane as 200 flying hours and the speed as 30 k. p. h. The number of aeroplanes therefore will be the

daily course (in kms.) \times number of days of operation.

200×130

Note: If a fraction is obtained, the number of aeroplanes required will be increased to the next whole number.

2. For pilots: half of the number of aeroplanes.

3. For mechanics: one for every 300 HP employed in the total number of aeroplanes.

The subsidized companies are required to equip their aeroplanes with all devices and arrangements to assure the public the maximum of safety and comfort and to carry out the orders of the State which may be made in this respect.

The subsidized companies are required to place their installations, material, and all their resources at the disposition of the State from the first day of mobilization of the Army, according to the plan of mobilization made in agreement with the Director of Aeronautics.

Penalties

If the regularity of service is not maintained owing to lack of personnel or material, poor organization or any other cause except "force majeure" and in the case of non-compliance with these regulations, the Director of the Administration of Civil Aeronautics may suspend the subsidy of the Company. In case of bad weather, departures may be delayed or suppressed by agreement between the representatives of the Government and the Company. The decision of the Government's representatives is final without, however, incurring the responsibility of the State.

If during three consecutive months the efficiency of the line drops below 25%, that is, if the total of paying passengers and freight carried is less than a quarter of the total available seats and load capacity the commercial efficiency subsidies will be suspended until the efficiency becomes more than 25%.

Non-compliance with the regulations contained herein entails the following penalties:

1. Warning.
2. Suspension of subsidies for one month.
3. Permanent suppression of subsidies.

Control

The control to which the companies are required to submit is of two kinds.

Technical control (bearing on the personnel and material employed.)

Administrative control.

Technical Control

This control is in the hands of a Technical Commission designated by the Administration of Civil Aeronautics and is made:

- On presentation of proposal.
- On starting the service.
- During the course of the service.

(a) *On presentation of proposal.*

The companies must send to the Administration of Civil Aeronautics forms giving the state of the material and personnel.

The Technical Commission is to assure itself:

1. That the aeroplanes to be used by the Company possess their Certificates of Navigation and are in perfect flying condition.

2. That the special modifications do not decrease the worth of the aeroplanes.

3. That the aeroplanes can fulfill the conditions (length of flights, load carried, etc.)

4. That the pilots and mechanics possess the proper licenses.

5. That the private landing fields used by the Company are in proper condition.

(b) *On starting the service.*

The Technical Commission verifies the identity of the conditions at this time with those mentioned in the proposal.

(c) *During the course of the service.*

The services are required to submit the first of each month forms relating to the condition of the personnel and material.

On variable dates the Technical Commission notes whether the pilots, mechanics and aeroplanes continue to possess the necessary qualities.

Administrative Control

This control is made by the proper services of the Administration of Civil Aeronautics.

- (a) On presentation of a proposal.
- (b) On starting the service.
- (c) During the course of the service.

(a) *On presentation of proposal.*

The control service is to assure itself:

1. That the Company is Belgian.
2. That the persons directing the enterprise are Belgian.
3. That the Company employs pilots and mechanics of foreign nationality only if Belgian pilots and mechanics are lacking.

4. That the Company possesses and will place in service the minimum number of pilots, mechanics and aeroplanes required by the State.

5. That the rates charged will not exceed those fixed by the State.

(b) *On starting the service.*

The control service verifies:

1. The agreement of the conditions of the starting of the service with those of the proposal.
2. Whether the aeroplanes have the proper Belgian licenses.

(c) *During the course of the service.*

The control service is to assure itself of the regularity of the service.

The Companies must send control forms to the Administration of Civil Aeronautics the 1st, 11th and 21st of each month.

In order to assure the execution of the article given above relating to penalties for delay in starting, a register will be kept in each aerodrome. The delays with their causes will be inscribed on a sheet signed by the Chief of Aerodrome and pilot or representative of the Company on the field.

To permit verification of the passengers and freight transported, the Companies must present to the Administration of Civil Aeronautics at the end of each month a resume of the passengers and freight carried during the month with the numbers of the tickets and luggage receipts as well as the prices of each.

At the time of arrival and departure the Companies must furnish to the Chief of Aerodrome all information judged necessary to control the subsidies.

The Companies must supply at the request of the Administration of Civil Aeronautics complete and detailed information as to their expenses and receipts as well as their balance sheets.

FULL SCALE DETERMINATION OF THE LIFT AND DRAG OF A SEAPLANE

By MAX M. MUNK

Technical Note National Advisory Committee for Aeronautics

Summary

The speed, barometric pressure, and number of revolutions of the engine of a seaplane were measured, including tests with stopped engine. The mean data obtained are given in the following note; the results of the gliding tests are used for the computation of the lift and drag coefficients, and by making use of them the results of the engine flights are used for the computation of the propeller efficiency.

The free flight tests described in this note were made by the author and Dr. Erich Hueckel at the testing station at Warnemuende during the summer of 1918, and are here

published for the first time. It was intended to develop a simple method for the examination of the aerodynamical properties of a seaplane independent of the characteristics of its propeller. The instruments had to be simple and self recording, and no long preparation of the aeroplane for the test could be allowed. On the contrary, the instruments had to be mounted in the aeroplane only a short time before the beginning of the test. The method was used with one aeroplane only, and the opportunity was taken to determine its lift and drag coefficients and the propeller efficiency.

The seaplane used for these tests was a German Brandenburg sea-biplane with the following characteristics:

strument in an airtight case, in which the static pressure rules. In this way, only the difference of the pressures affects the cover of the box. The pressure exerted on the cover is received by a spring. The box is so thin that no appreciable elastic reactions are produced, provided the forces act for only short distances. Hence the distance transversed from the cover of the box is proportional to the dynamic pressure. This distance is enlarged by the lever shown in the diagram and recorded on a drum. If only a short distance is left to the box and this distance is correspondingly magnified by a light lever, a short oscillation period is obtained and a correspondingly rapid response of the instrument.

In order that no acceleration may affect the instrument readings, the following counter-balancing must be done. It is first essential to render rectilinear accelerations non-effective in both the horizontal and vertical directions. This is accomplished by means of the counterweights P_1 and P_2 , which, in the acceleration of the instrument on account of its influence of inertia on the lever h_2 , exert a moment offsetting the moment produced by the lever h_1 , so that the pointer is not deflected. As regards the curvilinear accelerations, it is most important to offset those whose rotation axis is at right angles to the recording surface. These accelerations are rendered harmless by making the moments of inertia Θ_1 and Θ_2 , of the levers h_1 and h_2 , bear the same ratio as the lever arms a and b , hence $\Theta_1 : \Theta_2 = a : b$. The mass of the box cover, with half the mass of the box and the spring, is thereby to be included in Θ_1 . A curvilinear acceleration then generates in the connecting rod s a momentum coming from the lever h_1 , which is of like magnitude but opposite in direction to the corresponding force from the lever h_2 , so they mutually offset each other. In order that the inertia moments may satisfy the prescribed ratio, there are placed on the lever h_1 two like weights G equally distant from the pivot d_1 . By varying the distance of these weights from d_1 , the moment of inertia of this lever can be temporarily adjusted. Curvilinear accelerations about the other horizontal axis and about the vertical axis likewise generally produce moments on the lever axes. In order to eliminate the effect of these moments, the lateral positions of the counterweights P_1 and P_2 , on the axis of h_2 , must be so chosen that the moments arising on the lever h_1 will offset those on the lever h_2 .

When employing the manometer on rapid climbing aircraft, still another precautionary measure must be taken, in order to avoid the variometer effect of the instrument, which is caused by the volume of the case being considerably greater than the volume of the box. If the instrument is placed, for example, where the external pressure is higher, a certain interval of time will elapse, on account of the compressibility of the air, before the higher pressure has reached a state of equilibrium in the case, while this takes place more quickly in the box, on account of its smaller volume. The result is a deflection of the manometer. In order to prevent this, the air is likewise admitted slowly into the box, which may be accomplished by placing a suitable valve in the air inlet pipe. The amount of the throttling depends on the resistance of the air inlet pipes to the instrument. Of course it also has the effect of damping the instrument, but not enough to affect its responsiveness very much.

The instrument was made in the workshop of the Göttingen aerodynamic laboratory. The box is made up of ring-shaped corrugated membranes of sheet brass 1/20 mm. thick, soldered to brass rings. The pivots of both levers consist of knife edges, in order to keep the friction as small as possible. They are held

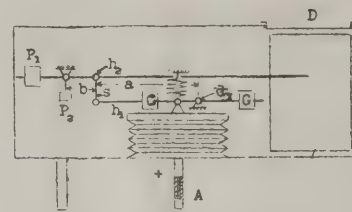


Fig. 1.

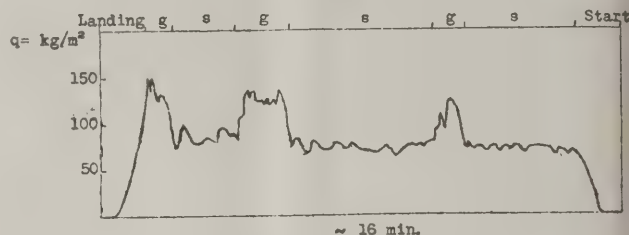


Fig. 2. Flight with Hanover C L II. s = climbing, g = gliding.

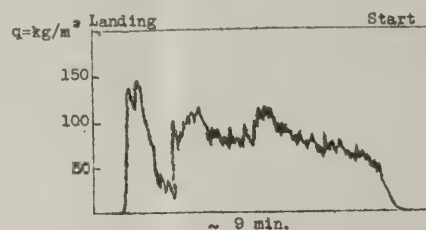


Fig. 3. Flight with Halberstadt C L IV in very squally weather.

lightly against their supports by spiral springs. All the other joints consist of leaf springs. The measuring spring is removable, so that the measuring scale may be changed when necessary. The stylus is made very light of thin sheet aluminum. The record is made on smoked paper. The drum can be introduced or removed after removing the cover D. The clockwork which drives the drum can be started or stopped by turning a small eccentric button on the bottom. The valve for preventing the variometer effect is located at A.

The instrument gave a good account of itself in the trial flights made at the end of 1919 under the supervision of Professor Proell of the Hanover Car Works. Figures 2 and 3 reproduce two of the records, on which all the details of the pressure variations can be readily recognized. That the counterweights actually produced the desired effect is demonstrated by the fact that the record shows no trace of the engine vibrations, while the record of another manometer, not counterbalanced, was spread out by these vibrations in the form of a band. In squally weather, no utilizable record could be obtained with the latter instrument. The drum, driven slowly by the clockwork, was occasionally rotated slightly in the opposite direction by the very strong vibrations. This effect found expression in a peculiar wave form in the vertical lines (Figure 3).

Translated by National Advisory Committee for Aeronautics

French Aeronautics

It is reported that the prize of one million francs offered for the best aero engine will probably be augmented by another million, offered by the French Air Minister, for engines of 350 to 450 h.p., and weighing not more than 2 lbs./h.p. It is understood that competing engines will have to pass a reliability run of 240 hours, in stretches of eight hours each, and that the total time taken in completing the 240 hours must not exceed 100 days. The competition will start on March 1, 1924, and entries must be received before December 1, 1923.

Announcement has been made that the Aviation Committee of the Colonial Exchequer have definitely decided to organize a contest for seaplanes from April 17 to 19, under three classes: under 150 h.p.; 150 to 400 h.p.; and over 400 h.p. Eliminary trials are to take place on April 17, when entered aircraft must ascend to 1,000 metres, and have on board, in addition to the normal useful load, sufficient fuel for 1½ hours flight. The course, Marseille-Monaco, is 413 kilometers. Prizes to the extent of over 40,000 francs are offered.

Belgian Competition

The Aero Club of Belgium has organized an International Competition for touring airplanes to be held at Brussels on June 23-25, 1922. The competition is open to touring machines, single-seaters or multi-seaters, whose engine capacity does not exceed 7 litres. The awards will be made for a total of 100 points, allotted as follows: 30 points for minimum space occupied in hangar; 30 points for general economy of the engine; 25 points for slow landing, and 15 points for quick get-off. The prizes are as follows: The King of Belgium's Challenge Cup, to be retained by the winner for one year; and the following cash prizes: 1st prize, 15,000 francs; 2nd prize, 7,000 francs; and third prize, 3,000 francs.

Argentine Aerial Club Opens

Consul General W. Henry Robertson, Buenos Aires, states that on January 6, 1922, the new flying ground and school acquired by the Argentine Aerial Club at San Isidor, alongside the grounds of the River Platte Aviation Co., were opened for use, more than 20 machines taking part in the ceremony.

Opportunity in Colombia

According to Mr. Edmund B. Montgomery, American Vice Consul at Barranquilla, Colombia offers an opportunity for the establishment of an air transport service. The facilities and carrying capacity of such a service, however, must be greater than that rendered by the present company (Colombian-German Aerial Transport Co.), which maintains a hydro plane service, and which, for the months of October, 1921, to January 1922, inclusive, reported 307 flights, aggregating 57,640 kilometers, 30 passengers carried, and 29,280 kilograms of freight transported. This company has a contract to carry mail for a period of five years, the Government subsidizing it to the extent of \$100 per trip.

As the river steamship transportation is uncertain in the dry season which is now coming on, an air service with machines carrying 10 to 14 passengers would undoubtedly get all the passengers and freight that could be carried, although one drawback to large air boats on the river is the danger of contact with driftwood in starting and landing. The ratification of the American-Colombian treaty should be a help in any negotiations which may have for an end the establishment of such a hydroplane service on the Magdalena River by American interests in co-operation with Colombians.

COMMERCIAL AVIATION DEVELOPMENTS IN EUROPE

By W. KNIGHT, M. E.

(Continued from page 109)

RUMANIA

Commercial aviation in Rumania has actually started its activities in 1921. In fact, it was only last October that the first aeroplane of the "Franco-Romane Aerial Transport Company" made its first flight from Paris to Bukarest.

The line Bukarest-Paris-Constantinople is going to be operated regularly this year. The trip from Paris to Bukarest will be made by starting from Paris at 6 P. M. and arriving at Bukarest two days after, early in the morning. For the year 1922, the "Franco-Romane Aerial Transport Company" will have an aeroplane provided with sleeping quarters for 20 passengers which shall be used on the line between Paris and Bukarest. This company is already operating the lines between Paris and Praga and between Paris and Warsaw.

The capital of the company is 10,000,000 of francs. This company, we might say, is an enterprise mostly financed and supported by French capital. In fact, the French Government gives 9 millions of francs per year as a subsidy to this company and the President of this company itself, is General Duval, former Chief of the Air Service in France.

The Polish Government also gives to this company 1,000,000 francs per year subsidy, payable in oil and fuel and, besides this, grants to the "Franco-Romane Aerial Transportation Company" the exclusive operation over the Polish territory for ten years.

The Czecho-Slovak Government also pays a subsidy of 5 million crowns per year, and grants to the company the exclusive right of operation for ten years. The Turkish Government grants to this company the monopoly for the transportation of the mail between Bukarest and Constantinople for five years, subject to renewal. The Rumanian Government, besides paying a subsidy to the company, grants it the exclusive right of operation on the line Paris-Strasbourg-Praga-Vienna-Bukarest-Constantinople.

The following project for the development of civil aviation in Rumania has been submitted by Mr. Mirea, Director of the Air Service under the ministry of transports in Rumania. The project starts with considering the following nine international lines passing through Bukarest.

1. London-Paris-Vienna-Budapest-Bukarest.
2. Trieste-Belgrad-Bukarest.
3. Athens-Salonica-Sofia-Bukarest.
4. Constantinople-Adrianople-Bukarest.
5. Constantinople-Costanza-Bukarest.
6. Hamburg-Berlin-Praga-Vienna-Budapest-Bukarest.
7. Dantzig-Warsaw-Leopoli-Bukarest.
8. Bukarest-Chisinau-Kiev.
9. Bukarest-Odessa.

In conjunction with these nine international lines, the following lines shall be operated:

1. Bukarest, Craiova, Trunu, Severin, (effecting the liaison with Belgrad); Temesvar (liaison with Seghedin, Budapest); Avad, Orodia (liaison with Delretin, Budapest).
2. Bukarest, Giurgin (effecting liaison with Sofia, Athens, Adrianople, Constantinople).
3. Bukarest, Tecuci, Iassy (liaison with Warsaw).
4. Bukarest, Costanza (liaison with Odessa and Constantinople).
5. Bukarest, Braila, Galatz, Chisinau (liaison with Ukraina).

Besides these lines, connecting together the various international lines, the following lines for the local traffic shall be operated:

Bukarest-Brasov, Bukarest-Pitesti-Sibiu-Cluj-Orodia, Galatz-Tecuci-Brasov-Sibiu.

Airdromes for these lines shall be provided at Bukarest, Craiova, Temesvan, Orodia, Costanza, Iassy, Vernovitz, Balatz, Chisinau, Turnu, Severin, Arad, Giurgin, Tecuci, Braila, Brasov, Pitesti, Sibiu, Cluj.

This project comprises also the establishment of an aircraft manufacturing plant capable of an output of 300 aircrafts per year. The capitalization of the company undertaking the development of this plan has been anticipated to be 260 millions of liras and the total cost of operation per year has been figured to be 144 millions of liras. The realization of this project will be effected mostly with foreign capital. French and British capital seem to be very much interested in its development and every facility will be granted by the Rumanian Government for the realization of this undertaking.

OTHER COUNTRIES

Besides France, England, Belgium, Italy, Germany and Rumania that we have considered so far, minor attempts for establishing civil aviation are more or less apparent in the rest of Europe. In some countries like Switzerland, we find that civil aviation activities are intimately connected with the tourists traffic and when we consider the beauty of the panorama of the Alps which can be obtained by flying over the mountains, we might expect quite a lively development of civil aviation there, however limited to excursions over the Alps and the lakes of Switzerland.

At the present time, the "Ad-Astra" of Zurich, is doing most of the commercial flying carrying passengers for excursions and also for taking photographs of the Alps from the air, which are sold to tourists at a good price.

A number of aerodromes and hangars have been constructed at Dudendorf, Geneve, Cointrin, Lausanne Blucherette, by the department of civil and military aeronautics. At Dudendorf especially, they have a fine aerodrome with twenty hangars and all modern facilities for testing motors and propellers.

Hangars and aero-ports for hydroplanes are to be found at present at Geneve, Lausanne-Ouchy, Locarno, Lugano, Lucerne, Korschack, Romanshorn and Zurich.

Landing fields for aeroplanes are now open at Avenches, Bellinzona, Zurich-Spreintebach, Aaran, Berne, Biere, Colombier, Frauenfeld, Thun and about two dozen of private landing fields are scattered all over the country.

Due to the geographical position of Switzerland and the Alps, which in some places reach in height to nearly 14,000 feet, international lines operated with commercial aeroplanes which are not designed for flying at very great altitudes shall find a barrier in Switzerland and shall have to avoid the route over Switzerland, in spite of the fact that it would make a short flight to fly directly over the Alps rather than circling around them over the routes, Paris-Venice, London-Milan, Munich-Bordeaux, Vienna-Lyons, etc.

There is now a project in Switzerland of forming a local company equipped with aeroplanes designed for carrying passengers with a sufficient degree of comfort over great altitudes, manned by pilots, well familiar with the exceptional atmospheric conditions prevailing over the Alps. This company would operate in connection with the international lines crossing over Switzerland and would take care of the transportation of the passengers from one side to the other of the Alps. In other words, this company would operate aeroplanes like shuttles over the Swiss border.

In Sweden, some attempts have been made by the Svenska Lufttrafik, A.B., last year for establishing an air mail service. The operation of this company, so far, is in an experimental stage. In the three months of July, August and September of last year, this company has operated the line, Stockholm-Reval, and 800 kilograms of mail matter have been transported. The distance between Stockholm and Reval is only 280 miles, which were covered on an average of between 2½ and 3 hours. Only 21 passengers have been transported and 92% of the scheduled trips were completed in the above named period of time.

In Spain, besides the French line operating between Perpignan and Casablanca there is the Madrid-Alicante line operated by a private concern and the Melilla-Algeiras operated by the Government. A project for a dirigible line between Spain and South America is now being considered.

In Norway, in the Netherlands and in Czecho-Slovakia some noticeable signs of real activities are to be found.

In August, 1919, "The International Aircraft Association, Ltd." (I.A.T.A.) was formed for the purpose of insuring a uniform exploitation of international lines, so as to avoid competition by agreeing on standard rates and technical requirements of aircraft used by the Aerial Navigation Companies in the membership of the I.A.T.A. At the present time, the following companies have joined the I.A.T.A., Danske Luftfartsselskab, Denmark; Danziger Luftreederei, Free State of Dantzig; Deutsche Luftreederei, Germany; Finska Lufttrafik; Finland; Koninklijke Luchtvaart Maatschappij, Holland; Svenska Lufttrafik, Sweden.

Conclusions

From the summary review that we have made of the status of civil aviation in Europe at the end of 1921, we might draw

a few conclusions which might be useful to us in establishing and operating aerial lines in this country.

The outstanding feature of Aerial Transport Companies in Europe, has been, first, the great interest shown by European Governments in providing these companies with sufficient subsidies to allow them to survive the first few years when they will have to operate at a loss, and also in providing a good organization of the aerological and wireless services, landing fields and signals for night flying, which facilitate the operation of the aerial lines and insures to a great extent, the safe operation of aerial routes.

Second, almost every aerial transportation company operating at present in Europe, is using aircraft not well adapted to the commercial exploitation which is required of them. Third, the cost of operation of these lines is greatly increased due to insufficient volume of commercial load and passengers carried over the lines flown. The cost of a ton per mile is too high as yet to successfully compete with other existing means of transportation. This being especially true over short lines where the saving of time effected is hardly in proportion with the increased cost of transportation.

The high cost of operation is due mainly to the overhead expenses which are entirely and unavoidably high as compared to the volume of business handled and is also due to the type of aircraft used.

The present limit of from 100 to 200 flying hours before overhauling aerial engines is ridiculous. Motor car engines have run 80,000 miles or perhaps 3,000 hours before over-

hauling, (and air engines run in far better conditions than any of the motor car engines).

The life of the most of the present commercial aircraft as used in Europe, is entirely too short and the depreciation of these aircraft over a rather short period of time must necessarily increase the cost of operation.

Insurance rates are at present too heavy a burden for the exploitation of aerial lines but this again is due mainly to the types of aircraft used and is due to the unperfected ground organization. A real sound ground organization will avoid accidents and will save labor expenses to the extent of something like 30% on the cost of that item in a carelessly administered business.

The present tendency in Europe is to effect both a vertical and horizontal combination of aircraft operating companies and aircraft manufacturers. This is of course, a sound policy which will prevent competition in rates and will act as a spur to each company for supplying better services and thus securing more business.

In Europe, laws and regulations affecting aerial navigation are being developed for both international and national operation of aerial lines. A good deal is yet to be done along these lines and the future of civil aviation developments along national and international lines depends on sound laws and regulations providing a fair guarantee of safety for the passengers, without imposing unnecessary restrictions to the operating companies which would hinder the commercial exploitation of aerial lines.

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ful and the air perfectly smooth. By this time the sky to the front had become entirely clear, the rest of the journey being made under the characteristic weather conditions of Texas, and without event. Ellington Field was reached at 10:15, and the Chief of Air Service immediately started an inspection which carried him up to some time after four o'clock. During this time he met all the officers of the field and gave them a short talk with reference to plans for Air Service troops in the 8th Corps Area. The talk was followed by a luncheon, after which an aerial review took place. Machines took off in formation in spite of the cross winds and bumpy air. Lieut. Johnson demonstrated great skill in flying in his demonstration of the Thomas-Morse pursuit plane. Aerial gunnery and bombing added much interest to the flying.

Prior to his departure for Washington that night, the General attended a dinner in his honor given by the Houston Chamber of Commerce at the Rice Hotel.

The Hawaiian Divisional Air Service

The 4th Squadron (Observation), Capt. H. H. Young, commanding, which has been stationed at Luke Field since January 24, 1920, has been relieved from duty with the 5th Group and ordered to proceed to Schofield Barracks to become the nucleus of the Hawaiian Divisional Air Service. Henceforth the function of the squadron will be solely observation in conjunction with problems affecting the Hawaiian Division. Accompanying the 4th Squadron to duty with the Hawaiian Division are the 11th Photo Section and Branch Intelligence Office No. 11.

Major George E. Stratemeyer, Air Service, has been assigned as Divisional Air Officer, Hawaiian Division. The flying field selected has been used as a cavalry drill ground, is well located near the railroad and road, has sufficient space for the erection of buildings, hangars, etc., and is large enough for any type of airplane. Canvas hangars are being erected, and the field is being cleared of weeds and underbrush, which has grown up in spots. The enlisted personnel are being quartered in the 35th Infantry Barracks, and the officers are assigned quarters in the 21st, 27th and 35th Infantry areas. A study of the field is being made, and estimates of funds for

necessary construction work are being prepared.

XBIA Planes on Cross Country Trips

During the week ending March 18th, the 13th Squadron at Kelly Field made seven cross country trips (13 flights), using five XBIA's and two DH's. These mark the first cross country trips ever attempted with the XB's, the ban on cross country on this type of plane, being only recently lifted. One plane was forced down, due to a broken oil lead, but same was repaired and the planes returned to Kelly Field without further mishap. The 13th Squadron pronounces them an ideal type of ship for cross country flying, if the vibration of the motor can be overcome. The gas consumption is very low.

Flying Time at Carlstrom Field

The records from the flying office at Carlstrom Field, Arcadia, Fla., show that the flying time for February totalled 1,563 flying hours. Some 93 student officers and cadets are at present undergoing flying instruction. These students are equally divided between two stages, and a force of fifteen dual instructors are instructing from the two stages. The present class of students will probably be the last one to learn to fly in Florida, due to the expected moving of the Primary Flying School.

Advanced Training of Flying Cadets

The advanced training of flying cadets at Mather Field is going along with particular success in smooth formation flying. Flights of eleven and twenty-three ships each have been practiced for the past ten days, with an officer as flight commander, the cadets piloting the other ships. These formations were part of the attraction at the Aerial Circus held at Mather Field on March 19th for the benefit of the Army Relief Society and the improvement of that field.

Status of 326th Observation Squadron

Excellent progress has been made in the organization of the 326th Observation Squadron, of the 101st Division, which is now 75 per cent. complete in its organization. The headquarters of the squadron is at Durand, Wisconsin; the headquarters of the 1st Flight Section is at Madison and

the headquarters of the 2nd Flight Section at Milwaukee. The Squadron Commander, Captain Horace P. Orlady, will soon have completed his permanent assignment of personnel, and hope is entertained that there will be some training this year for such officers as are available. The officers of the squadron are kept informed of its progress.

Joint Training of Coast Artillery and Air Service

The War Department is taking action to insure coordination of the Coast Artillery and the Air Service in coast defense, under the basic principles of warfare and training recently laid down. The chiefs of the two combatant arms concerned have been instructed to consider together the question of joint training, with a view to carrying out experiments in joint training and tests of material during the coming summer.

The war with Germany furnished such an exhaustive test of the powers of mobile troops that the doctrines of training for such troops were firmly established. Coast defense, however, was not so extensively tested, and many questions of the best methods and material to be used were not solved in battle. Since the war various experiments, such as the bombing of warships, have indicated the increasing power of aircraft in coast defense. It is with a view to developing the potentialities of this new arm, as well as to insure properly coordinated training, that the War Department is taking action.

Both branches undoubtedly have an important role in coast defense, and tests will be for the purpose of obtaining coordination in their training. It is expected these tests will include:

- (a) Anti-aircraft target practice against air targets to determine the vertical range at which bombing planes could operate without being subjected to effective fire.
- (b) Bombing practice against coast defense installations to determine the effect of aircraft bombs on such a target.
- (c) Combined target practice at extreme coast artillery ranges to determine the relative efficiency of bombing planes and large caliber coast artillery guns in operation against an enemy fleet.



NAVAL *and* MILITARY AERONAUTICS



General Patrick on Inspection Tour

It is doubtful if any chief of a War Department Bureau or other official even on a "hurried" trip, equalled the record time in which Major General Mason M. Patrick, Chief of Air Service, accomplished an inspection tour of Air Service stations in the Southwest. When it is considered that inside of five days the Chief of Air Service inspected Kelly Field, Brooks Field, Love Field, the Helium plant at Fort Worth, Post Field and Ellington Field, one may well wonder how it was done, especially in view of the fact that at three of the stations above mentioned he spent practically the entire day going through the buildings, examining the property and inspecting the personnel.

The answer is that, outside of the journey from Washington to San Antonio, and the return journey to Washington from Ellington Field, the General utilized the quickest and most comfortable method of transportation—a DH4B airplane. Major H. A. Dargue, on duty in the Office of the Chief of Air Service, Washington, piloted the General's plane, and Lieutenants Duke and Dunton from Kelly Field in another plane acted as an escort, the two machines being company for each other in the air. When stops were made, Lieuts. Duke and Dunton rendered service in attending to the details of securing gas and oil and making careful inspections of both machines.

The weather man was in a very surly mood during several days for this record inspection trip. His ill humor, however, availed him but little, for despite lightning, rain storms, low dark clouds and Oklahoma cyclones, the trip was completed with only a slight delay. The flying was greatly enjoyed by the General, and it is the longest trip by air he has thus far made—somewhere around 900 miles. The experience gained by him on account of the varied weather conditions, especially the flight from Post Field to Love Field, will undoubtedly be of great assistance to him in dealing with matters in which flying is involved.

Proceeding from Washington on March 6th, General Patrick arrived at San Antonio, Texas, early in the morning of the 9th. He made a thorough inspection of all Air Service establishments—Kelly Field Nos. 1 and 2, the Air Service Depot, and Brooks Field. Late in the afternoon of the 9th, after the inspection of Kelly Field No. 2, a delightful reception was tendered him, in which an opportunity was given all the officers and their families to be present. Dancing, with music by the Kelly Field orchestra, was very much enjoyed, and refreshments were served. In the evening the St. Anthony Hotel was the scene of a banquet tendered the General by the field officers of the Air Service at San Antonio. There were also present at his dinner General Hines, the Corps Area Commander; General Lewis, Commanding Officer of the Second Division, and a classmate of General Patrick; General Williams, the Chief of Ordnance, who had just arrived on an inspection trip; and several staff officers of the Corps Area Commander. General Patrick took the occa-

sion to inform the field officers during the course of the dinner of his plans to concentrate the Air Service as much as possible in the vicinity of Kelly Field. The Corps Area Commander made a few very complimentary remarks about the Air Service troops under his jurisdiction.

On the morning of the 10th, an aerial review was held, in which there was considerable formation flying and acrobatics. The GAX machine attracted a great amount of attention, due not only to the tremendous amount of noise it made, but to the expert flying performed by its pilot. On one occasion this "mighty air tank" came within inches of the ground at a tremendous speed and maintained this altitude while passing in review. The impression gained by the Chief of Air Service through the flying of the GAX was that its offensive power rested more in the roar of its motors than the roar of its canon.

The review at Kelly Field No. 2 was followed by an inspection of the Depot at Kelly Field No. 1. Following a luncheon at the Depot, the Chief of Air Service proceeded by airplane to Brooks Field and made a thorough inspection of that place, including the large airship hangar now nearing completion. Upon finishing his inspection at Brooks Field, he inspected the whole layout of Brooks Field, Kelly Field and the Depot from the air, and then proceeded to Camp Stanley to look over the bombing and gunnery ranges used by the groups stationed at Kelly Field. Observing the bombing and gunnery ranges from the air gave the Chief of Air Service a much better idea of them, it is thought, than he would have gained on the ground, as he saw the character of the surrounding country and the distance these places are from Kelly Field. He expressed the opinion that these ranges should be nearer to Kelly Field.

Early the next morning the Chief of Air Service was "on his toes" for the flight to Dallas, Texas. The day was a beautiful one, and it did not take long to roll off the many miles between the two places. The trip was made by way of Austin and Waco, and the 275 miles was covered in 2¼ hours—slightly over 2 miles a minute. During this trip the General was greatly interested in the character of the country and the air conditions, although he found he had plenty of time to read the San Antonio morning papers. At Love Field an inspection was made of the buildings and the large amount of surplus property. In the afternoon a trip was made to Fort Worth, where a thorough and very interesting inspection of the Helium plant was accomplished.

The trip from Love Field to Post Field—185 miles—was covered in a comparatively short time. The Chief of Air Service was shown Barron and Taliaferro Fields at Fort Worth (now abandoned). He saw the Helium plant from the air, and then looked over Call Field near Wichita Falls, also the great oil fields north-west of Wichita Falls, including the Burk Burnett Field. After passing into Oklahoma there was little of interest until Post Field was reached. As this was Sunday, and the visit of the Chief of Air Service was entirely impromptu, there

were no formal preparations made for his inspection. He went through most of the principal buildings at the field, however, and had a very pleasant visit with the officers. In the evening a very enjoyable dinner party was held in the Commanding Officer's quarters. Weather conditions appeared to indicate that the next day would be as fine as the preceding ones for a continuation of the travel by air.

In order to obtain a good start on Monday morning for the flight from Post Field to Ellington Field, everybody arose early, only to find low clouds, high winds and rain storms. Two machines went out a little before eight o'clock to determine the feasibility of making a start, but a ceiling of only 500 feet could be attained, and so it was decided not to attempt to get away until more favorable conditions existed. By 2:30 in the afternoon the rain storms had become less frequent and the clouds had lifted, due to the strong wind, so that a ceiling of 3,000 feet was obtained. Accordingly, the start for Dallas was made, but upon progressing southward it was found necessary to keep on a line toward Fort Worth, as a very heavy bank of dark clouds lay to the eastward, pouring rain on the country and causing many places to be visited with thunder-storms and, as was learned later, with tornadoes. There seemed to be a path, however, practically cleared all the way to Fort Worth, and so the flight that far was uneventful, except for going through two small rain storms and watching the maneuvers of the heavy clouds on the left. At Fort Worth it became necessary to turn eastward and plow into this wall of dark clouds. The pilots of the two planes zig-zagged around somewhat to find the most desirable place to go through, but when about midway between Dallas and Fort Worth a downpour of rain was encountered, accompanied by thunder and lightning. It was not long, however, before the airmen passed through this and were out of the rain, although forced fairly low by the heavy clouds. A landing was made at Love Field and, before the machines could be taxied into the hangar, the downpour of rain just passed through struck the field. It was too late at this time and the weather conditions too adverse to attempt to proceed to Ellington Field, and so a stop overnight was made in Dallas and plans formulated for an early start the next morning.

The weather on Tuesday morning appeared to be little better than the night before, but careful study indicated that the clouds were clearing towards the south and that better weather conditions would obtain the further south the pilots progressed, and so a start was made from Love Field at exactly eight o'clock. It was raining at the time, and the airmen did not get clear of the rain until some distance south of Dallas. A good ceiling was obtained, however, and for approximately the first hundred miles, flying at an altitude of 3,000 feet, the trip went very smoothly. Then the sun began to break up the clouds and the air became very rough. The planes ascended to a little over 5,000 feet, at which altitude the weather was delight-

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FOREIGN NEWS



French Air Mail Stamps

In the French Morocco colony a beautifully engraved set of three aeroplane stamps has recently been issued. The design represents an aeroplane over the town of Casablanca. The values are 75 centimes, 1 and 2 francs.

Gothenburg Aero Exhibition

The Aeronautical Chamber of Commerce has received the program for the International Aero Exhibition in Gothenburg. Details are as follows:—

"The City of Gothenburg, the foremost Swedish port with regard to navigation and export, will celebrate the 300th anniversary of its foundation, by a Jubilee Exhibition, to be held from the 15th of May to the 10th of September, 1923, embracing *inter alia* a General Swedish Export Exhibition and also an Exhibition by the Swedes abroad. In connection herewith there will be held the first Swedish International Aero Exhibition, 20th of July to 12th of August, 1923, in cooperation with the Royal Swedish Aero Club.

"The exhibition grounds are located in Gothenburg, on the field Exercissheden, the area of which amounts to 12,000 square meters, and besides a number of small buildings there will be erected a large exhibition hall, measuring 9,650 square meters.

"Aircraft destined to the exhibition may land and start on the aerodrome of Gothenburg at Torsland where competitions will even be arranged.

Extent of Exhibits

Group A. Flying Machines.

1. Aeroplanes.
2. Seaplanes and flying-boats.
3. Sundry aeroplane equipment.

Group B. Balloons and Aerostats.

1. Aerostats.
2. Free balloons.
3. Moored balloons.
4. Sundry balloon and aero equipment.

Group C. Hydroplanes (gliders).

1. Hydroplanes.
2. Sundry hydroplane equipment.

Group D. Motors and Propellers.

1. Motors for aircraft.
2. Propellers.
3. Sundry accessories.

Group E. Manufacture, etc.

1. Equipment for experiments.
2. Machinery for aircraft factories.
3. Devices for tests and control.

Group F. General Equipment for Aircraft.

1. Instruments for navigation and maneuvers.
2. Lighting and signalling.
3. Telegraph and telephone.
4. Photography (see group 1, 4.)
5. Parachutes.
6. Outfitting.
7. Sundries.

Group G. Material and Partly Finished Products.

1. Wood.
2. Metal.
3. Covering.
4. Pigments, dopes and varnishes.
5. Fuels and lubricating materials.
6. Sundry materials.

Group H. Aerodromes.

1. Hangars and equipment for hangars.
2. Mooring arrangements, slip-ways, pontoon docks, etc.
3. Lighting and signalling.
4. Hydrogene works.
5. Equipment for meteorological service.
6. Sundries.

Group I. Science, Literature, Instructions, Inventions, etc.

1. Aerodynamics.
2. Aerostatics.
3. Aerology.
4. Photography.
5. Laboratory equipment.
6. Training of pilots.
7. Commercial aviation.
8. Military aviation.
9. Aer mails.
10. Literature.

"With a view to judging whether the available exhibition grounds will prove to be sufficient, or if an enlargement of the buildings must be accomplished, the Board of Administration may ask for information already previous to the 1st of April, 1922, as to the approximate space to be reserved.

"Definite application to be given on form specially established, and to be in the hands of the Board on January 1st, 1923, at the latest.

"Such application for exhibition space is to be sent in and received conformably to the directions given by the Board for the purpose. The application to contain a complete list of those objects, the exhibition of which is desired, and the permission of such exhibition is granted on the condition only that no alteration be made unless approved of by the Board. The Board reserve to themselves the right to consider the applications, and, if there be any reason, to exclude exhibits.

"Any allotment of space to an applicant may be revoked, unless the applicant within a fortnight prior to the opening of the exhibition produces on demand a proof of his being able to exhibit the articles named in his application.

"The Board reserve to themselves the right to retrench exhibition space already allotted, provided that the respective exhibitor be notified thereabout before the 1st of March, 1923.

"Offices of Board and Secretary:—Johanneburg, Gothenburg 5. Telephone Nos. 16390 and 16394. Post Address:—Hug, Gothenburg, Sweden.—Telegrams:—Ilug, Gothenburg."

Food by Aeroplane

It is reported from Holland that exceptionally severe weather would have imposed great hardships upon the inhabitants of the many islands which lie to the north of the Dutch mainland, were it not for the timely assistance rendered by the big Fokker aeroplanes of the Royal Dutch Air Service Company. All boat traffic having ceased owing to the ice, the aeroplanes were used to deliver large quantities of food and other supplies to the islands.

The recent railroad strike in Germany has also provided an excellent opportunity for the Dutch Company during the otherwise somewhat unprofitable winter season. The Fokker planes left Rotterdam for Hamburg and Bremen, there to connect with the D. L. R. line to Berlin, three times daily, loaded to capacity with mail, express and passengers.

Forced Landing of Plane on Mt. Vesuvius

A dispatch from Naples, dated March 16th, states that an aeroplane proceeding from Rome, of the firm Sarri of Rome, arrived at Naples a few days ago, carrying on board an American cinema "Reporter." The aeroplane was piloted by the well-known pilot, Angelo Menegelli, of Viterbo.

On the morning of the 16th, the reporter wanted to continue the flight in order to take a moving picture of Mt. Vesuvius at a very low altitude, and Mr. Menegelli conducted the aeroplane on the great crater. A military aeroplane was following Menegelli's plane, and while they were flying around the crater of the volcano and the operator was engaged in taking pictures of the abyss, the motor suddenly stopped. The pilot, however, skilfully glided his plane and prevented it from falling into the crater, landing on a small space near by. The passengers got out safely from the irregular landing place, but the aeroplane was rendered unserviceable, its wings and fuselage being damaged.

Italian Aeronautical Events for 1922

At a recent meeting of the National Italian Aeronautical Federation final determination was made of aeronautical events to take place this year, as follows:

Trophy of the County, City and Chamber of Commerce

in Genoa—Genoa

Berardy Trophy for Balloons (International)—Milan

Piedmont Trophy—Turin

Baracca Trophy—Turin

Loreto Trophy—Loreto

Tyrranean Trophy (International)—Naples

Schneider Trophy (International)—Naples

Italia Trophy (International)—Milan

Parachute Contest (International)—Rome

Free Balloon Race—Rome

Mapelli Trophy—City and date to be set.

May
June
June
June
August
August
August
September
October
October

Successful Trials of the Aveline Automatic Pilot

A young Frenchman, M. Georges Aveline, has invented an automatic stabilizer which promises to go a long way in making flying practically safe. Experiments are now being conducted in France with this stabilizer by the Messageries Aeriennes Company, and a report on tests made on February 14th above Le Bourget in a Farman "Goliath" indicates that the stabilizer is capable of great services in traversing large banks of fog, and in taking off from aerodromes covered in fog. In this latest test several pilots were on board the Goliath, which flew through the fog and emerged into clear air after 1,500 meters altitude, effecting the climb without difficulty and without intervention from the pilot. At this altitude several turns were made, both left hand and right hand. The engines were then throttled down and the machine descended to within 50 meters from the ground, without the intervention of the pilot. During the descent the engines were several times opened up and throttled down, the machine automatically climbing when the engines were opened out and gliding when they were throttled down. Three times during the flight the pilots were changed, the machine flying entirely without pilot during these changes.

The above invention employs a form of the pendulum principle, and part of the device is electric, part pneumatic and part aerodynamic. The pendulum portion, which is only partly to be regarded as a pendulum, consists of an inclinometer in which the fluid is mercury. This mercury is contained in a disc with a narrow circular groove, and serves to make and break an electric contact which operates the valves that admit compressed air to the air cylinder whose pistons actuate the control cables.

A World's Speed Flight

Last autumn M. Sadi Lecoq, the famous French flier, and holder of the world's record for speed in an aeroplane, made an average of 206 miles per hour over four laps, using a Nieuport-Delage fitted with a 300 Hispano-Suiza engine. A little later Mr. J. Herbert James, holder of the British flying record for speed, flying a Gloucestershire Mars I plane, fitted with a 450 h.p. Napier engine, made an effort to beat Lecoq's record, and actually succeeded in doing 212 miles per hour over the lap, though his average for four laps was only just over 196. Since Mr. James' feat there has been much controversy as to whether his machine or the Nieuport-Delage is the fastest in the world. Lecoq's record was made flying both with and against the wind, whereas Mr. James' record on the one lap was made with the wind only. A British newspaper, the South Wales News, states that in order to settle this controversy Mr. James challenged M. Lecoq to a series of air races, to take place at Croydon, London, on the occasion of the Royal Aero Club's race meeting on Easter Monday next, for £500 a side and that M. Lecoq accepted subject to a return race being arranged in France. It is said that a series of flights will be carried out in order to eliminate flukes, and an effort will be made to break the existing world's record. The only possibility of the match falling through lies in the fact that the Nieuport-Delage machine lands at a speed of over 100 miles per hour, and the Croydon aerodrome may possibly be too small for a safe landing. The French airman will visit Croydon shortly to inspect the aerodrome, and if he is satisfied as to its size the contest will take place.

ELEMENTARY AERONAUTICS and MODEL NOTES

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Testing Aeroplane Steels for Hardness

THERE are a great variety of steels used in the making of aeroplane fittings, each selected for the particular work it is called upon to perform. In selecting the various classes of steel it is necessary to know the hardness of the metal so that it can be properly adapted to its work.

For testing the hardness of metals there are four typical methods. The sclerometer method, introduced by Turner; the scleroscope method more recently invented by Shore; the indentation test adopted by Brinell about 1900; and the drill test, introduced by Keep, a few years earlier.

The principles underlying each of the four methods are briefly as follows:

Turner's Sclerometer

In this form of test a weighted diamond point is drawn, once forward and once backwards, over the smooth surface of the metal to be tested. The hardness number is the weight (in grams) required to produce a standard scratch. The scratch selected is one which is just visible to the naked eye as a dark line on a bright reflecting surface. It is also the scratch which can just be felt with the edge of a quill when the latter is drawn over the smooth surface at right angles to a series of such scratches produced by regularly increasing weights.

Shore's Scleroscope

In this instrument, a small cylinder of steel with a hardened point, is allowed to fall upon the smooth surface of the metal to be tested and the height of the rebound of the hammer is taken as a measure of the hardness. The hammer weighs about 10 grains, the height of the rebound of hardened steel is about 100 on the scale, or about 6 1-4 inches, while the total fall is about 10 inches.

Brinell's Test

In this method, a hardened steel ball is pressed into the smooth surface of the metal so as to make an indentation of a size such as can be conveniently measured under the microscope. The spherical area of the indentation being calculated, and the pressure being known, the stress per unit of area when the ball comes to rest is calculated and the hardness number obtained. Within certain limits, the value obtained is independent of the size of the ball and of the amount of pressure.

Keep's Test

In this form of apparatus a standard steel drill is caused to make a definite number of revolutions, while it is pressed with standard force against the specimen to be tested. The hardness is automatically recorded on a diagram on which a lead soft material gives a horizontal line, while a material as hard as the drill itself gives a vertical line, intermediate hardness being represented by the corresponding angle between and 90 degrees.

New Model Club at College Station, Texas

Under the leadership of Staff Sgt. Joseph S. Ott, an enthusiastic group of model flyers are conducting meetings and work classes at College Station, Texas. Permission has been obtained from the College authorities for the use of one of the work shops, where the members meet every Saturday. The entire day is given over to this work exclusively.

Before joining the U. S. Air Service, Sgt. Ott was a member of the Illinois Model Aero Club, his home being in Chicago. This accounts in a way for the progressive spirit shown by the new club which now numbers twenty members. Under his attention models of many varieties are being built and experimented with. In order to give the best samples for the boys to work from, Mr. Ott himself built 12 models as follows: 3 eighteen-inch tractors; 3 twenty-one inch tractors, 1 thirty-inch pusher (which made a flight of 1,200 feet); 2 twenty-one inch tractor seaplanes; 1 thirty-inch single pusher R. O. G. (which climbs about 100 feet and flies 900 feet); 1 twenty-four inch tractor and one scale monoplane.

Although it is two years since building his previous models, Sgt. Ott has designed and built a most interesting type of "Parachute" tractor, which will be described in a later issue of Aerial Age. This model flies about 40 to 50 feet high, and releases a miniature parachute by means of a thread connected to the propeller shaft.

The first model built for one of the school boys, resulting in the idea of forming a club, was a 21-inch R. O. G. tractor, which made two flights of well over 600 feet and nearly always can be depended on for flights of 500 feet. Since the first group of models was built, the number of "stick-type" models constructed in one month by Sgt. Ott totals twenty-one. His pupils have made five successful 18 inch tractors so far.

Aviators to Study Ways of Birds High in the Air

Pilots of British commercial aircraft are to be asked to co-operate in solving some of those mysteries of bird life which have so long baffled all efforts of naturalists.

Airmen of the Continental expresses will, it is hoped, throw light on such fascinating subjects as the height at which huge flocks of birds fly when migrating to other lands, and what altitude they are able to attain in flight. They will also help in elucidating the speed of our feathered friends and in unveiling secrets that have baffled poets and scientists for thousands of years.

There are fascinating problems that may now be solved by our flying men. What power is it that enables migrating birds to traverse oceans and continents in a single flight? What connection is there between the weather and migration? After all else, how is it that birds can fly in the darkness of the night without fear of danger?

These are some of the mysteries that may be solved by aerial ornithologists.



A flying scale model of the Fokker FIII monoplane by M. J. Bayhi, as described in Aerial Age last week



RADIO DIGEST



New York Police Combine Radio and Aviation

Keeping fully abreast of the rapid evolution of radio development in these miraculous times of electrical control, the Police Department of the City of New York has in its aviation and radio division a reserve force of limitless potential value as a crime detector and arrester.

It claims to be the most efficient aerial unit in the world and, under the supervision of Rodman Wanamaker, special deputy police commissioner, in command of all reserves, has moved steadily onward from a small beginning to its present high place.

Its commanding officer is Colonel Fiorello H. La Guardia, a soldier with a fine record as an aviator on the battle fronts of the great war and later elected president of the Board of Aldermen of New York.

Its radio instruction is in the efficient hands of Captain Arthur C. Werther.

Inspector John F. Dwyer has had charge of the selection of pilots, and for four years the planes of this force have been flying about the harbor of New York, day and night, and have yet to report the first accident.

Major John F. Brennan is recruiting officer and has been instructed to recruit two more companies of cadets for the corps. His headquarters is at 156 Greenwich Street, Manhattan, where young men, physically sound, are wanted at once to take advantage of this offer of the city for a free education in two modern sciences—radio operating and aviation.

In this reserve aviation corps, in training and in active service, there are now four companies of officers and four of cadets, each company running to about one hundred men each. In the school there are always about two hundred young men in training. The enlistment period is for two years, the city furnishes the uniforms and all other equipment and gives to every cadet who finishes the course a thorough education in the mechanics of the gasoline engine, the science of aviation, piloting an airplane, radio telegraphy and telephony, meteorology and kindred subjects. Upon graduation a cadet is equipped to operate any vehicle, either on land, sea or in the air, that uses a gasoline motor for propulsion. He has acquired a trade that is of inestimable value to him, no matter what part of the world he may be in, for there is no part of the civilized world at this time that does not use either one or all of the forces in which he is qualified to operate.

Every cadet is required to master radio in every detail before being assigned to training for flying. He is taught the international radio code from the ground up, until he is qualified to handle the high-powered radio sets employed by the Police Department in actual police work. Here he is taught, first, to send and receive radio messages from the ground, later, he is sent into the air with another cadet pilot and taught to send and receive from an airplane in motion. This instruction he receives directly from the hands of Captain Werther, who is a master of the science and a tactician of high merit.

Besides giving a young man a valuable education in a well-paid trade, this special

reserve force educates in another manner. It takes the young man from the street corner, the pool room and the cigar store, where he may be led into temptation to violate the law and make of him a man, one who seeks to enforce the laws rather than to violate them. It teaches him discipline and self control, obedience to superiors and instills in him a pride in his work and in his knowledge of it. Under capable instructors he is taught swimming, boxing, fencing, wrestling, life saving; he plays baseball, handball and other athletic games, and is constantly developing under the instruction and influence of the environment in which others have advanced. From an embryo tough many a young man has been developed in less than the two-years' course into a clean living, healthy citizen of whom the city is proud.

The active personnel of the aviation division and radio corps under command of Colonel La Guardia consists of 102 flight and engineering officers and 160 cadets. It is through the generosity and public spirit of Rodman Wanamaker, Major John Gans, of Staten Island; Captain Theodore L. Bridgeman, Captain Paul Micellit of Sea Gate, and others, that this valuable service has been placed at the call of the metropolis free of cost to the taxpayers. It has cost a vast sum to maintain, but it has produced a corps of men trained in their art to such a degree that they will all be of priceless value to the federal government if they are ever called upon to defend it in time of need, at home or abroad.

Radiophoning from Airplanes

Radiophoning or radiotelegraphing from airplanes calls for the use of a ground wire connection just as much as it does when sending or receiving by wireless from stations on solid earth. Every neophyte knows that electricity travels in circles and that an impulse, once started on its career, keeps on going until it completes its circular course.

Every amateur, when he begins the construction of his home plant makes his ground connection as soon as he has his aerial erected. That completes the circuit and he is ready for the rest. But, suppose he erects his plant in a balloon and turns the bag loose, to drift at will. How is he going to maintain his ground connection with that sort of bird? How much worse, many ask, would it be if it were an airplane? How would it be possible to keep in contact with the ground when shooting above it at the rate of a hundred or more miles an hour? It is simple, if you know the secret.

To Pierre Boucheron, of the Radio Corporation of America, *The Globe Radio Magazine* is indebted for details on this interesting subject of scientific research, given in an interview by Eugene S. Bisbee. In the first place, the air itself acts as part of the "ground" through which the current shoots on its way to and from the airplane equipped with wireless apparatus. The plane carries a trailing wire attached to its transmission set in the cockpit of the fuselage, but this wire doesn't touch the ground at any time, except by possible accident.

Such an accident might happen if the operator neglected to draw in the "ground" wire when near the earth, in which event

there might be a catastrophe, for the wire is made of phosphor-bronze stranded cable, and is very strong and flexible. On its end it carries a weight of from one to three pounds or even more, depending upon the length of the trailer and the speed of the plane.

Equipped for radiotelephoning or radiotelegraphing, an airplane carries on its upper wings four insulated standards about a foot high, two on each wing end. These bear the aerial wires from which the messages are sent broadcast. The trailer extends from the body of the ship weighted as explained, for 100 or 150 feet. It is either let out when the 'plane has reached some altitude or is dropped gradually as the ship leaves the earth.

The length of the trailer for "ground" connection depends entirely upon the wave lengths with which the 'plane is operating, the average length being from 300 to 600 metres. From the apparatus in the body of the machine extends a metallic coil, at the end of which is the "ground" wire with its weight on the end. Messages sent to the flying ship from either the earth or another 'plane are caught on the end of the trailer and transmitted to the receivers of the telephone or telegraph on the head of the operator. The messages leave the machine through the aerials and return by way of the "ground" wire, thus completing the necessary circuit for all electric communication.

Radius of communication by airplane is of small importance, except at sea, the uses to which it is put being generally informative to the pilot of weather conditions on the surface. Twenty-five, fifty, or a hundred miles may be negotiated with an ordinary apparatus. This is sufficient to protect a 'plane travelling at the rate of more than a mile a minute or long enough to enable it to avoid danger during foggy weather or darkness.

Greater distances of communication require heavier apparatus, and this is a serious factor in flying. Small sized radio equipment is proportionately weaker than a large and heavy machine, carrying a heavier "ground" wire, and the noise and vibration of the powerful engines of an airplane prevent the operator hearing the weak signals that reach him from great distances. Up to twenty or thirty miles the signals received by an ordinary apparatus are strong enough to be heard distinctly above the roar and the rattle of machinery in the 'plane. Beyond this the electric impulse is too weak to break through the opposing forces and heavier apparatus is necessary for such work.

The vacuum tube is used with the transmission in the radiotelephone and the amplifier in the receiving end materially augments the sound of the signals. Yet the increase of distance operation must depend largely upon the makers of the motors that are used by the 'plane. Lessening of vibration and noise are more important than any other point, for weight in an airplane is a vital factor.

From a ground station an airplane may be directed by radiotelephone to a safe landing during a heavy fog that completely hides the surface of the ground. The pilot calls when he is within half an hour of where he assumes his station to be, say fifty miles away. During the succeeding

thirty minutes the messages may be practically continuous and the 'plane directed accurately as it nears.

During the flights between the Florida mainland and the islands of the Bahama group the passenger is constantly in touch by radio with both points and with other flying friends who may be in the air at the time. The "ground" wires trail during the entire flight and are hauled inboard when the ships near the ground. It would never do to rip loose a palm tree from one of those beautiful pearly beaches or anchor the 'plane to a coral reef by inadvertently overlooking the "ground" wire and its three-pound weight.

Loop Aerial Cuts Down Interference

How can any one living in an apartment house install a radiophone when the landlord refuses permission to put up an aerial on the roof? This is the most serious question that has confronted the radio fan since the big broadcasting stations commenced sending out a daily program of entertainment.

There are just two answers to this question, and both depend a great deal upon the location of the apartment house, its distance from the broadcasting station and the general conditions surrounding it. One is by means of an indoor aerial and the other by utilizing a so-called "loop" or coil aerial.

The latter is by far the best, because it not only can be used indoors, but it also has the property of cutting out interference to a maximum degree through its peculiar property of only recording signals when one of its edges is pointed directly at the transmitting station.

Its drawback lies in the fact that only a very small amount of current is picked up by it, and consequently it is necessary to use amplification in order to build up the current until it becomes audible in the telephone receivers.

The natural question which now arises on your minds, How can I build a loop aerial? I propose to answer this and then follow it up with a description of the manner in which a loop aerial is used. Before doing so, however, I want to point out that owing to the fact that most broadcasting stations are operating on a 300-meter wave there are many things which prevent us from taking the fullest advantage of present knowledge in connection with a loop, because of the difficulty of handling short waves and their terrific, high frequency.

A loop aerial suitable for reception of short-wave broadcasted music is best made in the following manner: Take two pieces of hard wood, six feet long and about three inches wide. Fasten them together in the middle, so that they are at right angles to each other. Next fasten a piece of hard rubber at each of the four ends, and groove the hard rubber so that it will hold the wire which is to be wound around it.

Upon the frame that you have now constructed it will be necessary to wind four turns of wire. For this purpose you will need seventy feet of 3x16x38 litzendraht wire. It will be necessary for you to wind this wire so that each of the four turns is spaced one-quarter of an inch from the others. This can be controlled by the grooves in the hard rubber.

When you have finished wiring this frame your wire will be square in shape. The two ends of the loop will come together at one corner of the loop. Cut off the excess wire, leaving about three inches at each end for making connections.

You have now not only an aerial, but also an aerial tuning inductance of a fixed value. If you now place a variable condenser of .001 micro-farad capacity across the two ends of the loop your tuning circuit will be complete, although a little closer tuning can be obtained by placing a small variable inductance in series with the condenser.

The next thing for you to do is to drill a hole through the center of your frame, where the two cross-arms are connected. This should be large enough to carry a spindle which will support the loop on a stand and permit you to turn the loop around in a complete circle. This is very necessary, as you will have to turn the loop around until one of its edges is pointing directly toward the station you wish to listen to.

Use Regular Amplifier

After you have done this you will have to connect a vacuum tube detector and two stages of audio-frequency amplification to the two ends of the loop where you have the condenser joined across. The regular cabinet form of detector and two-stage amplifier can be used for this purpose.

For persons living within twenty-five miles of the broadcasting station, it will probably be found that satisfactory results can be obtained with a loop aerial using only a vacuum tube detector and without amplification, but local conditions will determine this to a great extent.

There isn't any question about the advantages of a loop aerial. It eliminates all interference, except that which emanates from some point in a direct line with the transmitting station. It also eliminates a great deal of static.

Where it is impossible to put up a loop because of the amount of amplification needed results may be obtained by using an indoor aerial. This can be done by laying 150 feet of No. 18 covered bell wire around the picture molding of a room and joining one end to the instruments where the outdoor aerial is usually attached. In this type of aerial a ground connection will be necessary, which, by the way, is not necessary with a loop aerial.

Reception by means of a loop aerial will be greatly improved as soon as effective means have been discovered for the application of radio frequency amplification on short waves. Radio amplification is very simple with very long waves, but no great success has yet been obtained with short waves. When it has it will be possible to use an indoor loop aerial almost anywhere in the country.

—New York Tribune.

New Charging Battery Works As You Sleep

Radio, the new national pastime, which already numbers its disciples by the hundreds of thousands, is stimulating immensely the popular interest in electricity.

Itself an electrical manifestation, it requires certain electrical equipment, and in some cases this equipment is arousing radio enthusiasts to the unique value of electricity to mankind in general, especially to home dwellers.

Undoubtedly this opening of the eyes, so to speak, begins through the necessity of charging the storage batteries used in radio sets. These batteries have to be recharged frequently, and if the radio operator was compelled to take the battery each time to a battery service station it would mean considerable trouble, expense and time.

Double Purpose

Hence the popularity among radio folk of gas-filled rectifiers for charging these batteries. And if the radio amateur is also an automobile owner, the rectifier has for him a double usefulness, since it will recharge the starting and lighting battery in his car as well as the radio battery of his receiving set.

To many radio followers this gives a big importance to the function of electricity in the home—a function that is many-sided.

Rectifiers originally devised for other uses are now finding new application in the radio field. The Tungar battery charger is a type of gas-filled rectifier in use for some years to recharge automobile batteries, and now developed to serve a similar purpose in recharging radio batteries.

This rectifier is made in various sizes, from small outfits intended for railway signal work up to large service station sets which will charge ten or twenty automobile batteries simultaneously. For radio work, however, the small, portable type in 2-ampere and 5-ampere capacities is the best for the purpose.

Familiar System

The electrical theory on which they operate is similar to that of the two-element vacuum tube with which the average radio fan is familiar. The essential part is a bulb, or glass tube, which contains a cathode and an anode. The cathode is a short tungsten filament and the anode—or, in terms of radio, the "plate"—is a graphite disc.

After being exhausted of all air, the bulb is filled with argon, an inert gas. This is the chief difference between the Tungar bulb and other two-element bulbs, such as the Flemming valve and the kenelectron.

The vacuum tube depends for operation on the emission from an incandescent filament of small particles of negative electricity called electrons. The electrons themselves are the only current carriers, so that consequently the tube will rectify only a small amount of current at a comparatively high voltage.

In the case of the Tungar bulb, the electrons emitted by the heated filament ionize the gas, thereby making it conductive. This ionized gas acts as the principal current carrier, with the result that the bulb operates with a very much lower voltage drop (5 to 10 volts) and is capable of passing a current of several amperes.

The action of the bulb is similar to that of a one-way valve. During one-half of the cycle, electric current flows through the bulb from anode to cathode; that is, from the "plate" to the filament. But during the other half of the cycle, no current can flow. Hence the term "half wave" rectifier.

The 2-ampere Tungar will charge a 6-volt battery at two amperes, or a 12-volt battery at one ampere. The 5-ampere outfit will charge a 6-volt, 3-cell battery at five amperes, or a 12-volt, 6-cell battery at three amperes.

The Tungar is a product of the well-known research laboratories of the General Electric Company. Its use will enable the radio amateur to keep his receiving station always active. An inactive station is the one thing the radio fan abhors. If his set is out of commission for several days, because his battery has run down, he knows that he may miss some of the best air features of the season.

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AERIAL AGE WEEKLY

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(Continued from page 123)

miles across deserts and plains and concentrated in any troublesome spot without the fatigue of forced marches. Thus, before a savage enemy expects attack he can be pounced upon by powerfully and perfectly fresh force."

A layman can readily understand the great military power of modern air forces in the cases cited above.

Foreigners have not been first, nor are they alone, in recognizing the vital importance of air forces. Ten years ago Admiral Fiske declared that we could best defend the Philippines and our other foreign possessions by air forces. An Admiral Simms has recently asserted: "The command of the air means the command of the surface, whether it be sea or land. The experiment of sinking the Ostfriesland by aeroplane bombs proves that if our coast is protected by aeroplanes no ships can reach our shores or land troops."

Thus, the best authorities at home and abroad are of one mind—that air power will dominate in future war.

In the meantime what are we doing? Actions speak louder than words. In truth, it may be said that the United States dawdles. The aviation bureaus of the army and navy are doing all in their power with the limited and crude facilities they possess, but their hands are more or less tied. Appropriations for aviation are insufficient and conservatism continues to place hurdles in its path.

Moreover, legislation and laws for the encouragement and regulation of civil aviation are held up. The Wadsworth Hicks bill for Federal control of aeronautics, after passing the Senate, is being mangled, if not strangled, in the House by flaw-pickers and all sorts of seemingly jealous personal or bureaucratic influences. And little legal minds with state rights, personal rights and property rights preying upon them in this modern age, are supporting Farmer Brown in his claim that he owns all the air between his cow pasture and the moon, and that no trespassing aviator can fly through or breathe his oxygen without paying for it by the cubic inch!

Thus, while aviators are flying all over Europe, and when we are told that "a night air line between London and Paris will be in operation soon to carry the mails," when we are assured that "sleeping car aeroplanes will soon be in operation for tired business men who must cross the Channel quickly," while all these advances are being made abroad the government of the United States appears to be asleep at the switch.

The need of prompt and intelligent action is imperative. Aviation, both in peace and in war, is already a dominating force.

—Quarterdeck, in the N. Y. Tribune.

AERIAL AGE

WEEKLY

VOL. 15, No. 7

APRIL 24, 1922

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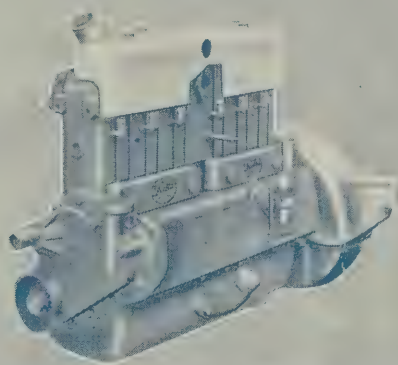


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April 24, 1922



Vol. XV, No. 7

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OL. XV

NEW YORK, APRIL 24, 1922

No. 7

Amundsen's Aeroplanes

RAOLD AMUNDSEN calculates that his drift on the Maude from Point Barrow, or thereabouts, to Norway by way of the North Pole will take five years. The distance from Point Barrow to North Cape, Norway, is about 500 miles. Captain Amundsen has just started in a metal monoplane for Seattle, which is some 3,000 miles from New York. It will be a flight with stops, but the distance could be made by daylight and a full moon in about thirty hours. The explorer naturally wants to learn how his new ship is sailed, or if he is to stand where Peary made his North Pole observations on April 6, 1909, the monoplane may be very useful. The drifting Maude should eventually shake herself free of the ice and emerge into blue water somewhere off the coast of Norway, unless the pack destroys her, but the chances of her passing very near the Pole are not bright. At some point the explorer would probably have to leave her and march or fly in the direction of the Pole.

There might be a risk in seeking the ship after a "dash" toward the Pole if it were necessary to depend upon dog sleds. The Maude might not move very fast, but if the explorer and his picked companions were absent from her for weeks there could be danger of missing her altogether. Polar weather is treacherous. It is easy to go wrong on the ice expanse; moreover, leads or open water may occur when explorers are at the end of their resources. Captain Amundsen wisely decided to take two aeroplanes with him, one for important flight work and another for scouting. The big metal plane has already been down in the Arctic Circle at very low temperatures. Both machines should be great time-savers if the Maude's drift carries her within quick flying distance of the Pole. It should be comparatively easy to pick her up after an excursion in any direction.

Admiral Peary foresaw the use of the aeroplane for Arctic exploration as long ago as 1912. In his book "The Secrets of Polar Travel" (1917), he said: "Five years ago at the annual dinner of the Explorers' Club I ventured the prophecy that in five years the polar regions would be reconnoitered and explored through the air." He made his "drive" for the Pole from Cape Columbia on the northern coast of Grant Land, which is less than 500 miles south. He went on to say:

"From Cape Columbia it is less than 1,400 miles in a straight line directly across and over the Pole to Cape Chelyuskin on the Siberian coast, the most northern point of Eurasia. To reach Frangell Island across Crocker Island and the entirely unex-

plored region between the Pole and Bering Strait it is about 1,500 miles. From Cape Columbia to Spitzbergen it is 900 miles, to Franz Josef Land less than 1,000 miles and to Point Barrow about 1,400 miles.

It is relevant to note that the metal monoplane acquired by Captain Amundsen has kept the air for more than twenty-six hours and has already flown from Mineola to Fort Norman in the Arctic Circle, 6,000 miles. It is conceivable that under favorable conditions this plane could be flown from Point Barrow to North Cape, Norway, with a stop in the neighborhood of the Pole, but Raold Amundsen is too experienced an explorer to face such desperate risks. The drift by the route the Melville-Bryant cask No. 2 was supposed to take is theoretically both safe and sure, and the North Pole can best be reached by an aeroplane in the hands of those who understand its limitations.—*Editorial in N. Y. Times.*

Air Transport in Europe

SINCE the war political and physical handicaps to railway travel in Europe have been tantamount to discrimination in favor of air transport, which knows neither the limitations of international boundaries nor the time consuming factor of overworked and in many cases decrepit rolling stock. The result of this unintentional though none the less real subvention of air transport has been the development, especially in France, of commercial flying services that already are in a fair way to rival the fast railway trains for passenger and express traffic.

The French Air Ministry reports that the distance covered by French commercial planes alone in 1921 was nearly 2,000,000 miles. Flights by these planes numbered 6,000, passengers carried were 10,330, merchandise freight weighed 366,278 pounds and postal matter 20,758 pounds. The figures for passengers and cargoes are three times as large as those of 1920 and ten times those of 1919.

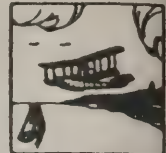
There are eight companies in France operating air routes, which radiate in all directions from Paris. It is now possible to take off from the French metropolis in a plane of any one of the eight companies any day in the week and reach London, Amsterdam, Prague, Warsaw, Nice, Barcelona, Alicante, Malaga, Bilbao or Havre. In most cases the return trip can be made by regular service in a single day.

In 1922 the subsidy for the French commercial air service is 41,382,000 francs, or about \$4,000,000. England comes second

(Continued on page 166)



THE NEWS OF THE WEEK



National Flying Meet

New York—More than sixty aeroplanes have already been entered in the first of the national flying meets sanctioned by the Aero Club of America and the Aeronautical Chamber of Commerce which will be held at Curtiss Field, Garden City, L. I., N. Y., Sunday, April 30, it was announced.

The Rotary Club of New York is supporting the event which is designed to show the progress made in the development of American commercial aircraft during the last six months. Many new types will be flown in the various exhibitions and contests, which include races, speed trials, parachute jumping, efficiency and performance tests and passenger carrying. The Rotarians will have a special section reserved for them and their friends. It is the first of a series of such flying meets to be held throughout the United States this year, to demonstrate to the business and professional public the peculiar qualities of the flying machine in speed and economic operation.

In its announcement of the flying meet, the Aeronautical Chamber of Commerce points out that "while 275,000 persons traveled by air in this country last year—by far a larger number than in all Europe—the aeroplane is a difficult machine with which to demonstrate. Instead of driving up to his front door and inviting the business or professional man to take a ride, as is the custom with the motor car salesman, the man who would demonstrate an aeroplane must first get his audience out to the flying field where he can provide a close-up of the machines in actual operation." Through courtesy of the Curtiss Aeroplane & Motor Corporation, their field has been made available for the New York meet, which is the first of its kind to be held.

"With the co-operation of the Rotary Club and other organizations," reads the announcement, "it is hoped to put before the traveling and transportation public this year free aerial exhibitions which, because of the large scale with which they are presented, can not help but convince the average person that flying is a practical method of travel. It is believed that the meet at Curtiss Field April 30th will be as instructive as it is entertaining."

Two Airplane Hangars for Hartford

Hartford, Conn.—Two mail service aeroplane hangars offered to Hartford by the United States Post Office Department have been accepted by the Hartford Aviation Commission. The hangars will accommodate six planes and will be set up on the municipal aviation field here. Their erection is expected to be completed in May, and would facilitate a possible air mail service to New York and Boston in the future. The hangars were offered for a fraction of their cost, it was stated, to encourage aviation here.

National Advisory Committee for Aeronautics Meets April 20

Washington—A program for aeronautical research and development for the coming year will be considered by the members of the National Advisory Committee for Aeronautics at its semi-annual meeting, to be held in the Navy Building on Thursday afternoon, April 20.

The Committee, which is headed by Dr. Chas. D. Walcott, is composed of independent and Governmental scientists and engineers. The scientific research and development undertaken during the past year in both civil and military aviation will be reviewed. Problems of aeroplane wing design, new developments in aeronautical engines, methods of testing aeroplanes, wings and parts, airship studies, lifting gases, aerial routes, the air mail service, and problems for the advancement of commercial aviation are among the subjects to be discussed.

Dr. Joseph S. Ames, Chairman of the Executive Committee, will outline the future plans of the committee with a view to placing America "foremost" in the development of aviation, as President Harding has recommended to Congress.

Dr. S. W. Stratton, Secretary of the Committee, will render a report on organization and the committee's activities in placing technical information on aeronautics where it will do the most good.

The development of a new type of aircraft engine with a view of eliminating the fire hazard by the use of heavy fuel oil in place of gasoline, will be among the subjects discussed. Special studies and tests of a new high-speed aeroplane wing, believed to be of great value in the interests of military scout planes, will be recounted by Dr. Ames. The allocation of the annual budget for special research problems will be discussed by the members.

During the sessions, Orville Wright and John F. Hayford, members of the Committee, will make a trip to the laboratory of the Committee at Langley Field to inspect the laboratory and make suggestions in connection with the tests and experiments contemplated.

Paul Henderson, the new Second Assistant Postmaster-General, who has charge of the Air Mail Service, has been invited to attend the meeting in view of his interests in aviation.

As an independent branch of the Government, the Committee holds itself in readiness to serve the President, the Congress and the executive departments in connection with aeronautical problems. The study of governmental aeronautical activities, recommendations for action under the International Air Navigation Convention concerning the development and regulation of civil aviation, and encouraging aeronautical engineering are among the duties of the Committee.

The members of the Committee expected to attend the meeting are:

Dr. Chas. D. Walcott, of the Smithsonian Institution, Chairman.

Dr. S. W. Stratton, of the Bureau of Standards, Secretary.

Dr. Joseph S. Ames, of Johns Hopkins University, Baltimore, Md., Chairman of the Executive Committee.

Maj. Thurman H. Bane, Army Air Service, Dayton, O.

Dr. Wm. F. Durand, Leland Stanford Junior University, Calif.

Prof. John F. Hayford, Northwestern University, Evanston, Ill.

Prof. Charles F. Marvin, Chief of the Weather Bureau, Washington, D. C.

Rear Admiral Wm. A. Moffett, Chief of Naval Bureau of Aeronautics, Washington, D. C.

Maj.-Gen. Mason M. Patrick, Chief of the Army Air Service, Washington, D. C.

Dr. Michael I. Pupin, Columbia University, New York City.

Rear Admiral D. W. Taylor, Chief Constructor, U. S. Navy.

Orville Wright, Dayton, Ohio.

Spokane News

Spokane, Wash.—Raymond Small and George Stonebraker, of Lewiston, Idaho, are negotiating for airplanes to open an air route from Lewiston via Grangeville to the Chamberlain basin on the middle fork of Salmon river, for the accommodation of hunters who desire to visit that game region.

The distance between Lewiston and the basin is about 100 miles, and under present conditions the trip involves seven days of toil by horseback and pack saddle. Fuel for the final leg of the flight will be loaded at Grangeville.

To negotiate the trip planes will require to attain a height of 10,000 feet on leaving Grangeville, for in case of trouble the plane must return to Grangeville or glide into the basin.

It is planned to cross the Salmon river brakes at an altitude of 5,000 feet. The Salmon river gorge is about 9,000 feet. Passengers will be able to look down to the canyon 14,000 feet below. Chamberlain basin includes about 500 acres of meadow lands, affording good landings.

By a contract signed up with the Curtiss Airplane Corporation the United States Aircraft Company of this city is authorized agent of the Curtiss firm, and entitled to sell ships throughout the northwest, according to announcement made by C. H. Messer, head of the local concern.

"We will immediately put in a complete stock of parts for Curtiss ships and motors as well as carrying the stock of Standard ship parts, as we do at present," Mr. Messer said. "This will give us the agency for ships and parts for the entire northwest. We will carry complete parts for every ship now flying in the district."

COMING AERONAUTICAL EVENTS

AMERICAN

- Apr. 30.—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.
- May —National Balloon Race.
- Sept. 4.—Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
- Sept. 15.—Detroit Aerial Derby, (about) Detroit. (Pulitzer Trophy Race.)
- Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

- Aug. 1.—Coupe Jacques Schneider. (about) (Seaplane speed race.) Italy, probably Venice.
- Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.
- Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

The AIRCRAFT TRADE REVIEW

American Aeronautical Developments

Washington.—Some of the achievements in the progress of aviation in America will be revealed for the first time by Dr. Joseph S. Ames, of the National Advisory Committee for Aeronautics, in an illustrated public address in the New Building of the U. S. National Museum at 2:45 P. M., Tuesday, April 25.

Dr. Ames will review some of the remarkable scientific achievements of the Committee's laboratory at Langley Field, Va., and will describe and explain the operation of newly developed instruments for the determination of the characteristics of aeroplanes in flight, which will enable the designer and builder to design planes of particular performance characteristics, such as high speed maneuverability. New instruments developed at the Committee's laboratory indicate the pressure distribution over the surface of an aeroplane in flight including the control surfaces, the results of which will have an important bearing on the safety factors used in the construction of aeroplanes.

Two entirely new methods of determining aerodynamic properties of aeroplane wings such as lift and resistance, will be discussed by Dr. Ames: They are the trailing wing method and a new form of wind tunnel. Instruments for determining the stresses produced on aeroplanes when violently maneuvered, as in spins, barrel rolls, and loops will be shown and the results discussed.

Members of Congress interested in aeronautics have been invited to listen to Dr. Ames' remarks through the courtesy of the National Academy of Sciences, under whose auspices his address will be given.

Personal Par

Laureston Craig, former aviation instructor, and a former member of the advertising department of the New York Commercial, will sail on the steamer Finland, April 22nd for Russia, where he will be assigned to child feeding work of the American Relief Administration.

Mr. Craig, who is a native of Island Falls, Maine, was a member of the class of 1919 at Colby College, but he interrupted his studies to enlist in the U. S. Air Service. Serving at Dorr and Barren fields, he was made an instructor in aviation, and was later on duty at Carlstrom and Post Fields. Following his discharge from the army he resumed his studies at Colby College, graduating with the class of 1920. Since that time he has been in business in New York City.

National Balloon Race

The Aero Club of America announces that the American National Balloon Race will be held this year from Milwaukee on May 31, 1922, under the auspices of the Aero Club of Wisconsin. The following prizes are offered: 1st \$1,000, 2nd \$800, 3rd \$600, 4th \$300, 5th \$200, 6th \$100.

In addition to the above, \$100 will be paid toward the expenses of each contestant who actually starts. The entry fee (for

civilians) is \$50 payable to the Aero Club of Wisconsin, to be returned when the contestant arrives at the starting field with his complete equipment.

The starting field (the Milwaukee Ball Park) is limited to approximately ten balloons, and applications for entry will be accepted in the order of their priority. It is expected that the Army will have three entries and the Navy three.

The three leading teams at the finish will in all probability be chosen to represent this country in the International Gordon Bennett Race which starts from Geneva, Switzerland, on August 6th.

All applications and requests for information should be addressed to the Aero Club of Wisconsin, 208 University Building, Milwaukee, Wis.

The Drag of C Class Airship Hull With Varying Length of Cylindrical Midships

A model of the C class airship hull, when severed at its major section and provided with a cylindric mid-body of variable length, had its air resistance increased about in proportion to the length of the mid-body up to 3 diameters, and in about the manner to be expected from the increase of skin friction on this variable length. For greater length the drag increased less and less rapidly.

As usual for such models, the drag for any fixed length, at 20 to 60 miles an hour, is accurately of the parabolic form $R V^n$ and hence the drag coefficient is of the hyperbolic form $C V^{-n/2}$, where n is lightly less than 2.

The variation of C with length is stated in the conclusion.

A copy of Report No. 138 by A. F. Zahm, R. H. Smith and G. C. Hill, may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Michigan Airways Organized

The Michigan Airways has been organized in East Lansing, Michigan, to engage in aerial photography, aerial advertising and exhibition flying. Arthur J. Davis is president of the company and Talbert Abrams, vice-president. Mr. Davis was instructor at Kelly Field during the war and Mr. Abrams was associated with the Curtiss Company at Buffalo, New York, prior to the war and served in the Marine Corps during the war.

Localized Radio Landing Signals for Aeroplanes

Radio direction finders and other devices have been in use for some time to assist airplanes in landing during the night, fog, or at other times of poor visibility. The most usual method of employing radio for this purpose is to transmit from any ordinary elevated antenna at the landing field radio signals which are received on a direction finder carried by the airplane. Such a method gives the direction of the landing field but does not tell accurately the distance from the plane to the field.

Several years ago the Bureau of Stan-

dards was called upon to develop a method to assist airplanes in accurately locating the landing field when the airplane was quite close at hand. A method was desired which would give a signal heard over a comparatively large area when the airplane was at a high altitude but would be localized within a small area when the plane was near the ground. A method employing a large horizontal coil tuned to 500 cycles was tried but did not prove satisfactory. The use of radio frequency waves was, therefore, undertaken and two horizontal coils, one above the other, with current flowing in opposite directions, were used. A fairly high radio frequency, such as 300 kilo-cycles, was employed in this case.

A calculation was made which indicated that the signals radiated from the 2 coils would be the strongest for an airplane flying in a given horizontal plane whenever the airplane was within a comparatively small ring-shaped area located above the landing field. The results of these calculations were verified in practice.

The Bureau of Standards has just published a paper giving the theory of the radiation from an antenna consisting of 2 horizontal coils such as that described above. The area within which the signal is heard and the point at which it is most intense are discussed. The results of these investigations are given in Bureau of Standards Scientific Paper No. 431, "The Field Radiated from Two Horizontal Coils," which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents per copy.

First Pursuit Group to Hold Meet

The First Group (Pursuit), now stationed at Ellington Field, will celebrate its Organization Day (May 5th), this year, with flying and athletic activities on May 5th and 6th. This celebration will be worth while to induce anyone interested in aviation to travel across the country to witness it.

An invitation is extended by the First Group (Pursuit) to all persons interested in air activities to be present at Ellington Field, Houston, Texas, on those dates.

The following events will be a part of the program:

1. Flying: Aeroplane races of every description; exhibition of aerial combat, aerial acrobatics, gunnery, bombing and acrobatic formation flying; exhibition of various types of aeroplanes, motors, maintenance equipment, and flying training equipment.

2. Athletics: Boxing bouts, baseball games (Ellington Field vs. Kelly Field), volley ball championship game, track and field meet.

It is especially desired that all Ex-Service Pilots be present as every Air Service Station in this vicinity will have a large delegation at Ellington Field, and the event will be a reunion and gathering of Air Service friends.

REACHING THE STARS BY AEROPLANE

Being the Tale of Movie Luminaries Who Have Succumbed to the Lure of "Giving 'er the Gun!"

By CHARLES L. GARTNER

ONE of the dreams of the average movie fan is to gain an interview with his or her favorite star; to sit down in a quiet little corner and ask all the intimate questions he or she has wanted to for a long time. But, to the layman, most of the screen lights are harder to reach than a bank president during a Bolshevik riot. Only in exceptional cases does the admirer of the silver sheet get a chance to get in personal contact with the luminaries of the silent drama.

One of the surest ways, figuratively speaking, of getting the ear of a star, is

authors and even cameramen are aviation enthusiasts, many of them being licensed pilots.

What may come as somewhat of a surprise to many movie fans is that Mary Miles Minter, one of the youngest and best known of the ingénues on the screen today, has qualified for a license as pilot. Miss Minter successfully passed the test over a year ago but parental objection has prevented her from taking advantage of her pilot's card. She is not permitted to ascend with the controls in her own hands.

Cecil B. DeMille, director-general of the Famous Players-Lasky Corporation, is one of the pioneers of aviation in the motion picture center of the world. Mr. DeMille, for a long time, was part owner of a passenger aeroplane company which made regular trips from Hollywood to nearby cities. He is also one of the most prominent figures in aviation on the coast and often takes his "bus" out for a few dips and tail spins in order to forget the cares of his office. Mr. DeMille asserts that there is no better tonic in the world for "that tired feeling."

Dorothy Dalton, star in Paramount Pictures, is another ardent advocate of the "travel by aeroplane" slogan. Miss Dalton's specialty is hydroplaning, for she much prefers the water route than the solid earth below.

A more recent addition to the ranks of the flying stars is Betty Compson, the girl of "The Miracle Man" fame. Although kept extremely busy out on the coast Miss Compson manages to find an occasional hour or so every few days to devote to the thrills of flying. Miss Compson has yet to win her pilot's license but hopes to secure the coveted card before she is many months older.

But perhaps the most enthusiastic, for aviation, of the movie people on the coast is Jeanie Macpherson, scenario writer for Paramount Pictures. Miss Macpherson has been flying for at least three years and

is one of the most prominent aviatrixes in California. She numbers among her acquaintances many of America's leading aviators, and she has participated in more "stunt" and "circus" flying than any other person connected with the motion pictures who is not paid for risking his or her neck. She has made a number of trips with Ormi Locklear, world famous "stunt" man, from whom she learned many of the finer points of the art of flying. The news of Locklear's tragic death some time ago came as a genuine shock to her.

Speaking of Locklear, Miss Macpherson said, "Ormi Locklear was, to my mind,



Betty Compson, star in Paramount Pictures

to mention aeroplanes. Almost the entire movie colony in Hollywood is aeroplane struck. Directors, stars, scenario writers,



Jeanie Macpherson, scenario writer for Paramount Pictures

a natural flyer. His judgment in the matter of height, and in that of keeping the plane level, was uncanny. I remember one trip I took with him out on the coast in which he took me out to sea. We unexpectedly ran into a dense fog. I was frightened to death, as we could hardly see each other, but Locklear, without ever bothering to consult his instruments, kept right on going, and when he thought we had gone far enough he turned his machine and headed back again.

"If I had had the machine there is no doubt that I would have been flying to Canada, Mexico or the open sea, but in short time we were out of the mist and to my great surprise, and greater relief, found that we were headed straight for our own landing place. I believe Locklear, with that sixth sense of his, could fly his 'boat' in the dead of night, without a light to guide him, and get through safely. That's why I can't understand some of the reports which were circulated about Locklear losing control of his machine on a difficult loop."

Eddie Rickenbacker, America's famous ace, is another close friend of Miss Macpherson's. In fact, Rickenbacker was Miss Macpherson's tutor at one time.

The writer knows of a little incident that shows Miss Macpherson's love for flying. Some time ago Miss Macpherson came East preparatory to sailing to



Gloria Swanson and C. B. DeMille witnessing an aerial circus

Europe for a well deserved vacation. As the case with all motion picture celebrities of the motion picture world, a great deal of Miss Macpherson's time during her short stay in New York City was taken up by interviewers from newspapers and magazines. One interviewer, who had been in the flying corps overseas, had been bumping Miss Macpherson on the cut and tried subject of scenario writing. The conversation was lagging when the gentleman in question suddenly looked at his watch and mentioned the fact that he would have to leave as he had an appointment with some one at the Aero Club. That proved to be the opening edge for a conversation that lasted far beyond Miss Macpherson's dinner hour and incidentally, long past the time set for the appointment at the Aero Club. Needless to say, the subject discussed was aeroplanes and, much to the surprise of the ex-service man, Miss Macpherson spoke fluently upon the respective merits of aeroplane motors of foreign



Dorothy Dalton, star in Paramount Pictures

and domestic make. The writer can testify to the above fact, for he had to sit through many weary—to him—minutes of technical descriptions of the Hipsano-Suiza, Liberty, etc. Than which, to the layman, there is nothing more complex.

AEROPLANE WILL CARRY SUSPENDED WING IN TEST

A FULL-SIZED aeroplane wing suspended below an aeroplane in high speed flight will shortly be tested at the Langley Field Laboratory of the National Advisory Committee for Aeronautics. This will be the first time that a real wing has been tested in actual flight, and is the final step of developing a new method of testing the performance and lifting properties of aeroplane wings.

This new method was developed by the National Advisory Committee for Aeronautics, which is composed of 12 American scientists who devote a large part of their time to the solution of aeronautical problems—without compensation. The method recently demonstrated successfully with model wings in air flights, consists in carrying the wing to be tested below an aeroplane in flight and, by means of suspension apparatus and recording instruments, to measure the forces of lift and resistance directly from the wing.

A complete aeroplane cannot be tested in flight as there is no means nor method of measuring the factors desired; there is nothing to suspend the plane from and its lift or pull cannot be measured by instruments carried on the plane itself.

Heretofore tests of new wings have been made in one of the following manners: Years ago, Dr. S. P. Langley used a whirling arm which carried a small model of the wing at its extremity; the Wright Brothers and many others used the wind tunnel method, which consisted in placing a model of the wing in a tunnel-like structure through which a draft of air was forced; later a method was devised for carrying a larger model of a wing above a motor vehicle or railroad car. All of these methods, while giving interesting results, have been found lacking in the accuracy desired in the design of aeroplanes. The information available to a designer should be sufficiently accurate to enable him to predict the ultimate actual performance of a wing on a full-sized aeroplane. In the whirling arm and the wind tunnel methods of test, errors were found to exist due to the small size of the model that could be tested; while in the method of carrying the wing above a vehicle, the interference of the ground and the wind was responsible for the inaccuracy. In short, the reason that none of these methods proved entirely satisfactory is that the method and equipment used did not even remotely approach the actual conditions of flight.

It was with this in mind that the new method was evolved, in which every detail has been arranged so that the test conditions are as close to the conditions of actual flight as is possible. Under the new method a model wing is constructed of full size and the conditions of test as to speed and altitude of flight can be selected to suit the aeroplane in which the wing is intended to be used, and the qualities of its lift and resistance can be measured directly without an overburdening amount of mathematical calculation. In the preliminary tests of the new method using small models several difficulties were met and overcome and the results obtained are encouraging to the extent that the testing of full-sized wings is in preparation.

The new method consists in suspending the wing to be tested upside down below an aeroplane in flight. It is supported by

three steel wires at such a distance that there is no interference from the aeroplane or from the "wash" of its propeller. The wing is inverted so that the lift becomes a downward pull, keeping it away from the aeroplane, and the amount of the pull being equal to the lift when right side up. With the wing so suspended it is possible to measure its lifting force on spring balances directly through the suspending wires, and its resistance from the angle of these wires to the vertical. This, on its face, appears of little difficulty, but as it would be obviously impossible to leave the ground or to land with the model hanging below the aeroplane, it was necessary to take off with the wing hauled up against the plane and to devise a means of raising and lowering the model wing after the plane was in the air. It was in perfecting this apparatus that considerable difficulty was experienced, and twice while in flight the model got beyond control and broke away on one occasion, colliding violently with the tail surface causing considerable damage and threatening the destruction of the aeroplane in the air and loss of life to the test pilot and engineer. However, remedial changes were made in the apparatus and more careful handling of the wing has reduced this hazard to a minimum.

The method was originated by F. H. Norton, Chief Physicist in charge of aeronautical research at the National Advisory Committee's Laboratory, and the preliminary tests were carried out by him with the assistance of Thomas Carroll, Test Pilot of the Laboratory staff. Twenty flights have been made with the perfected apparatus carrying a model wing six feet long by one foot wide, and the results obtained have checked with remarkable accuracy with the known performance of the full-sized wing of similar proportions upon a full-sized aeroplane.

The testing requires calm air conditions to give the best results and the flight path must be in a straight line. For the purpose of demonstrating the possibilities of the method, however, several flights were made on days when the air conditions were far from ideal and turns made with the wing suspended. It is possible to vary the angle of the model wing to the wind by raising or lowering the rearward suspending wire and the angle is read, with the aid of a telescope, from a small inclinometer or spirit level attached to the model. As the model is carried from twenty to thirty feet below the aeroplane, it is necessary to reel in the suspending wires until the model is close up to the body before a landing may be attempted. It has been found that in gliding onto the field at customary speeds, forces are developed by the model which are nearly capable of tearing it loose. This has been easily corrected by approaching the ground at lower speeds.

While these experiments developed by the National Advisory Committee for Aeronautics are of a preliminary nature they have excited considerable interest among aeronautical men both at home and abroad. The results of the experiments upon the full-sized wings are eagerly anticipated, in the hope that they will solve the problem of providing the aeroplane designer with absolutely accurate performance data, at less cost than for inaccurate data heretofore obtainable.

THE "UNIVERSAL PROPELLER"

By DAVID L. BACON

Langley Memorial Laboratory

THE improvements in aeroplane performance and fuel economy which may be realized by the use of a variable pitch propeller are unquestioned and their more frequent use, particularly on supercharged and multi-engined aircraft, has been delayed principally by the lack of satisfactory designs.

The reversible propeller also has shown decided advantages in decreasing the run of aeroplanes on landing and in the maneuvering of airships.

The helicopter problem which has for centuries been a fertile field for inventors is now attracting more serious attention than ever before and offers attractive possibilities if the obstacle of very large propellers, variable in pitch and of extremely light weight, can be successfully overcome.

A new design which avoids some of the objectionable features of other reversible propellers is therefore of more than passing interest.

At the request of the National Advisory Committee for Aeronautics the "Universal Propeller" was operated and explained by the inventor, Mr. Spencer Heath, for the purpose of demonstrating the following features of its design.

1. Elimination of continuously running gears, collars or bearings in the pitch control mechanism.
2. The use of engine power in place of manual labor in changing the blade angle.
3. The absence of any structural limitation to the range of blade angles available and the possibility of limiting the blade travel between any two predetermined extreme positions.
4. Continuous indication on the instrument board of the blade position.
5. Automatic throttling of the engine while the propeller is passing through the position of neutral pitch.

Description of Propeller

The present propeller and operating mechanism represent an experimental development rather than a refined design and as they were built entirely to shop sketches, no scale layout could be obtained and the writer's accompanying sketches are necessarily crude and incomplete.

The two wooden blades are fastened into steel sleeves which in turn are held in a steel hub similar in construction to that

used by Hart and others, the centrifugal forces being taken on ball thrusts and torsional and axial forces on plain bearings.

The method of fixing the wooden blades into the steel sleeves is noteworthy. The butt end of each blade is tapered outwardly at a small angle as shown in Fig. 1, and the surrounding collar is split so that it may be first sprung over the butt and then compressed upon the taper.

Pitch Changing Mechanism

The pitch changing mechanism is operated through the application of a braking force to either one of a pair of small brake drums surrounding the engine crankshaft and normally rotating with it. The elementary principle is shown in Fig. 2 which represents a brake drum connected through a gear train to the individual blades of the propeller. It is apparent that if the drum is allowed to revolve at crankshaft speed, all the gears will be stationary relative to the propeller and that the pitch angle will remain constant. If, on the contrary, the brake drum is held stationary the gear train will be set into action and the pitch angle of the blades will undergo a continuous change until the brake drum is released.

In order to change the blade angle in the inverse direction a second brake drum may be used, connecting to the worm shaft through an idler which serves to reverse the direction of rotation of the worm shaft. It should be noted that during normal flying none of these gears are operative and that the blades are locked in position by the non-reversible feature of the worm and the friction of the connected parts.

The actual construction of the pitch changing mechanism used by Mr. Heath is shown in Fig. 3. It will be seen that the mechanism has been somewhat complicated by the necessity of obtaining a large speed reduction ratio between the brake drums and the propeller blades. The brakes are applied through leather faced aluminum shoes operated from the pilot's seat by a light push and pull knob attaching to a brake lever mounted on the drum housing. A small hand crank is provided

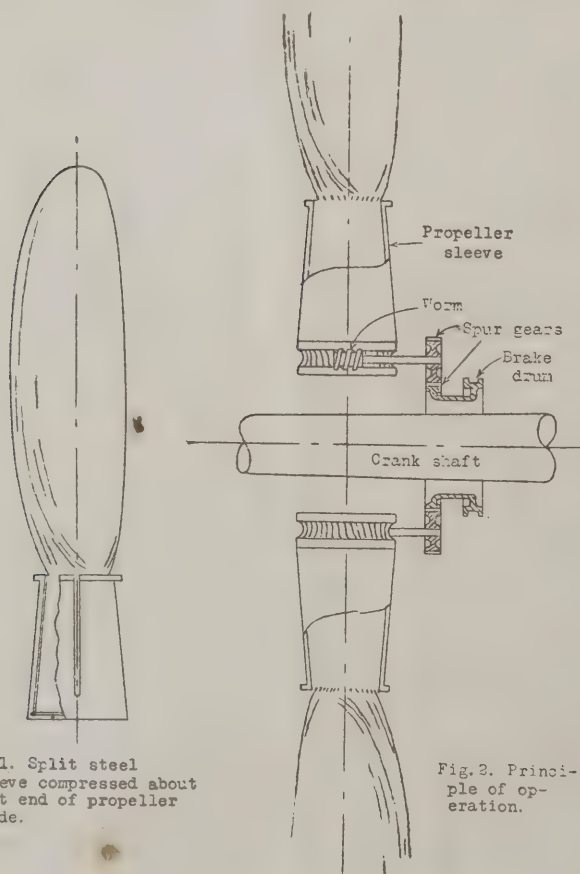


Fig. 1. Split steel sleeve compressed about butt end of propeller blade.

Fig. 2. Principle of operation.

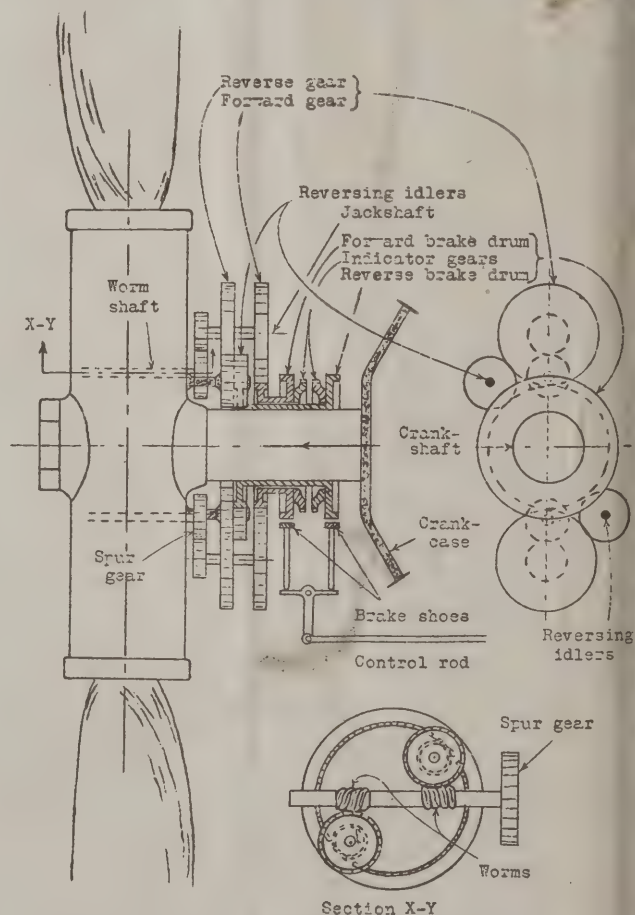


Fig. 3. Pitch changing gear train.

by which the pitch can be changed while the engine is not running.

Blade Position Indicator

The angular setting of the propeller blades at any instant is a function of the relative motion which has taken place between the two brake drums. The indicating mechanism is therefore operated by gearing from the two brake drums which conveys differential motion to the indicating pointer and the throttling and pitch limiting cams. As long as the two brake drums revolve both at crankshaft speed the indicating hand remains stationary while if either of them is retarded an angular motion is shown on the indicator equal to that experienced by the blades themselves.

Automatic Throttle Control

The mechanical throttle is provided with springs in both directions so that the pilot can at any time by applying a force in the throttle greater than the initial tension in the springs substitute manual for automatic control.

Pitch Limiting Mechanism

In the pitch limiting mechanism the control knob normally connects to the brake levers direct, a push increasing and a pull decreasing the pitch. If the control button is held in either operating position until the limiting position of the propeller blade is reached the cam trips a latch plate and renders the control inoperative in that direction while leaving it ready for use in reversing the direction of propeller blade rotation.

Demonstration Under Power

To show the action under power the propeller and related

mechanism were installed on a 150 HP Hispano-Suiza engine mounted with gasoline tank, observers' seats, etc., on a lumber trailer weighing about two tons which was free to roll on the ground between two chocks a few feet apart. The engine and propeller were operated both by Mr. Heath and the writer and put through their entire range of performance, which included disconnecting the pitch limiting mechanism so that the blade angles were controlled throughout a complete revolution of 360 degrees, both forward and reverse.

With the engine turning at about 1,000 r.p.m., the angular change from full speed ahead to full speed astern was accomplished in about five seconds.

Conclusions

The present mechanism, although but a crude embodiment of the inventor's principle, fulfills his claims as listed at the beginning of this report, and might easily be redesigned into a practical flying accessory.

It is obvious that some of its advantages are gained at the expense of additional complication and the question immediately arises whether they are worth it. In the opinion of the writer the novel features of this propeller are of sufficient value to warrant its redesign in a compact and lighter unit for prolonged service tests on either aeroplanes or airships. Any pitch changing mechanism for use on a helicopter must necessarily be designed as an integral part of the structure, and it remains to be seen whether designers will care to use Mr. Heath's patented ideas or will prefer to undertake the additional and by no means simple task of inventing and perfecting some mechanism of their own.

PUBLICITY BY AEROPLANE

By ANDRE CARLIER*

of the Compagnie Aérienne Française

No one can now foresee the new applications which circumstances may any day bring forth for the utilization of the aeroplane, aside from commercial transportation. We must try to discover them, as the only means of assisting aviation to live. One of the most important branches of aerial activity is publicity by aeroplane. It may assume various forms and has already been employed with marked success.

In the first place, aerial photography will henceforth constitute one of the resources of every publicity agent for any large company. Why? Because the most natural desire of a chief of industry or a wise manager is to show the world that his factories exist, that they are in perfect order and that they cover a respectable area. Twenty years ago there were artists who specialized in this kind of illustration, with the aid of photography. With great difficulty, by climbing to the top of a chimney, they obtained a more or less successful bird's eye view. Everybody has seen on catalogs these pretty pictures with diminutive people on the ground and delivery wagons larger than the buildings themselves. Though some were well done, most of these pictures were infantile.

We know a celebrated factory on the Marne, the manager of which did not hesitate, at the time of the Chicago exposition, to build a wooden tower, 60 meters (nearly 200 feet) high, in order to obtain a single panoramic photograph. At that time there were no aeroplanes.

Now all the large manufacturing plants have in their files superb aerial photographs taken at an altitude of 500 to 800 meters and showing their establishments from all sides.

These views serve alike for illustrations in catalogs and for letter heads. They can be reduced for making post cards or enlarged for placing in waiting rooms or offices, or for decorating the stands at the next fair or exposition.

These panoramic photographs show in a striking manner the designs of our castles and parks, and will constitute the best advertisements for our architects.

Aerial photographs will serve to advertise estates and building lots and each one can select his lot without visiting it, because the real estate company will have in its office the field itself, with its trees, its meadows, its brooks and rivers and all shown in relation to one another much better than on the estate itself.

They will be of service to engineers in planning factory extensions.

This will be the best way to exhibit in other countries the beauty spots of our own country, either by the use of lantern slides or by a collection of handsome enlargements.

Publicity by aerial photography will not stop here. Magazines and newspapers will resort to it more and more. After the catastrophe at the Baden Aniline Works, "L'Illustration" immediately requested the "Compagnie Aérienne Française" to send one of its operators by aeroplane to take aerial photo-

graphs of the ruins. In 48 hours the aeroplane departed, the photographs were taken and the negatives delivered to the journal which published, the following Saturday, a large double-page picture of the catastrophe.

Aeroplanes are coming daily into more extensive use, not only for taking aerial photographs but also for the rapid transportation of pictures taken by ground photographers. The "Daily Mail" employs no other means for transporting its photographs and kinetograms.

Another method of advertising by aeroplane is to drop circulars, either directly or with the aid of parachutes. Experience has demonstrated that all papers falling from the sky are immediately picked up and religiously carried away by the person who is able to get possession of them. In order to add interest to this method of advertising, it is evidently necessary to drop a large number of circulars, for a few thousand do not make much show. On the contrary, when a million or two circulars of all colors are dropped on a city or any large gathering, inside of half an hour, the effect produced is enormous. If, in order to increase this effect, a thousand parachutes, weighted with any kind of advertisement, are dropped, the crowd simply goes wild to get hold of them.

This method of advertising is of interest not only to manufacturers of products of wide consumption, like food and pharmaceutical preparations, etc., but also to large banks for arousing interest in popular loans. The Crédit Lyonnais resorted to this method at the time of the last government loan. Our aeroplanes, in fact, can come into direct contact with the thrifty man in his provincial city, in his village, and even, if necessary, in the fields and at his plough.

All these methods of publicity can be made still more effective by assembling, in advance, several thousand people at the same place, which is the object of the "Reunion Aérienne." These "aerial gatherings" may last one day or several, or even a week, like the one recently held at Dinard by the D. R. P. (League for the defense and rehabilitation of the country,) which was a great success.

An excellent advertisement for an exposition or a fair is the organization of an aerial taxi service between the city and the grounds. The Germans showed a perfect understanding of this fact, when they organized during the last Leipzig fair, an aerial service between that city, Berlin and the other large cities of Germany.

The promoters of the Lyons fair are considering a similar plan for next year.

From what we have seen, we may conclude that the employment of the aeroplane for advertising purposes is still in its infancy and that, by constant collaboration with other means of publicity, such as the daily papers, bill-boards, etc., results may be obtained, the importance of which it is still difficult to estimate.

(Translated by the National Advisory Committee for Aeronautics.)

* From "Premier Congrès International de la Navigation Aérienne," Paris, November, 1921, Vol. II, pp. 147-149.

HYDROSTATIC TEST OF AN AIRSHIP MODEL

AN airship model made by the Goodyear Rubber Company, was filled with water and suspended from a beam and the deformations of the envelope studied under the following conditions:

- (a) Both ballonets empty;
- (b) Forward ballonet filled with air;
- (c) Rear ballonet filled with air;
- (d) Both ballonets filled with air.

Photographs were taken to record the deflections under each of these conditions, and a study was made to determine the minimum head of water necessary to maintain the longitudinal axis of the envelope under these conditions. Additional photographs were taken of the model filled with air and after filling with water before any adjustment of the suspension was made. The form of the cross section when filled with water was obtained by bending a heavy piece of fuse wire to conform with the surface and then by laying the wire on paper and tracing the shape. The effect of filling with water on the length of the model was also noted.

Apparatus Used.—As may be seen, from the following photographs, the model was suspended from a framework in front of a vertical screen of cross section paper having lines one inch apart. The tension in the cords was adjusted by screwing up the nuts on the $\frac{1}{8}$ -inch brass rods which ran through the beam, as shown in the photographs. The lower ends of these rods were bent to form hooks into which the cords were tied.

Conditions of Test.—Six cords on the end, both forward and rear were run to a single ring and fastened. In this test they were run through the ring in order to provide for adjustment of each cord. The rings were held in place by a wire, which may be seen in the photograph, and which was fastened to the Vee, at the end of the third cord from the end on each side. When filled with water an upward force was exerted near the stern at the position occupied by the rudders and fins on the airship. The weight of the fins and rudders on the full-size airship is 480 pounds. The forces acting on the

model are $\frac{1}{30.18}$ times those on the full-size airship; hence this

upward force was made $\frac{480}{30.18}$, or 15.9 pounds. This force was

measured by supporting a stick at its middle on a knife edge and hanging a weight of 15.9 pounds on one end; while from the other end, as is shown in the photographs, the stern of the model was suspended. It will be noted that the moment

exerted by this force, tending to tip the stern up, is $\frac{1}{30.18^2}$

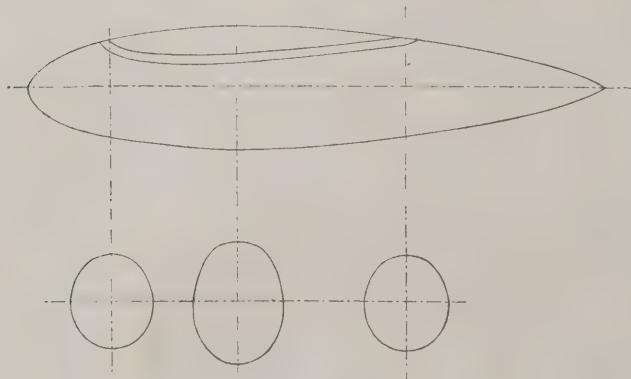
times the moment of the rudders and fins on the full-size airship, and as the cords were adjusted to a length equal to ap-

proximately $\frac{1}{30.18}$ times that of the full-size airship, the moment

of the weight of the model about the ends of the cords near the beam is $\frac{1}{30.18^2}$ times the moment in the full-size airship; hence

the moment exerted by 15.9 pounds is correct in this report. It may also be shown that the stress in the fabric caused by

* This report is a slightly revised form of the unpublisher Report No. 22, Construction Department, Navy Yard, Washington, D. C.



this moment is the same as in the full-size airship. The sticks under the band were simply to distribute the force of the band in a way similar to that in which the force of fins and rudders is distributed in the full-size airship, and prevent the band making a deep indentation in the model.

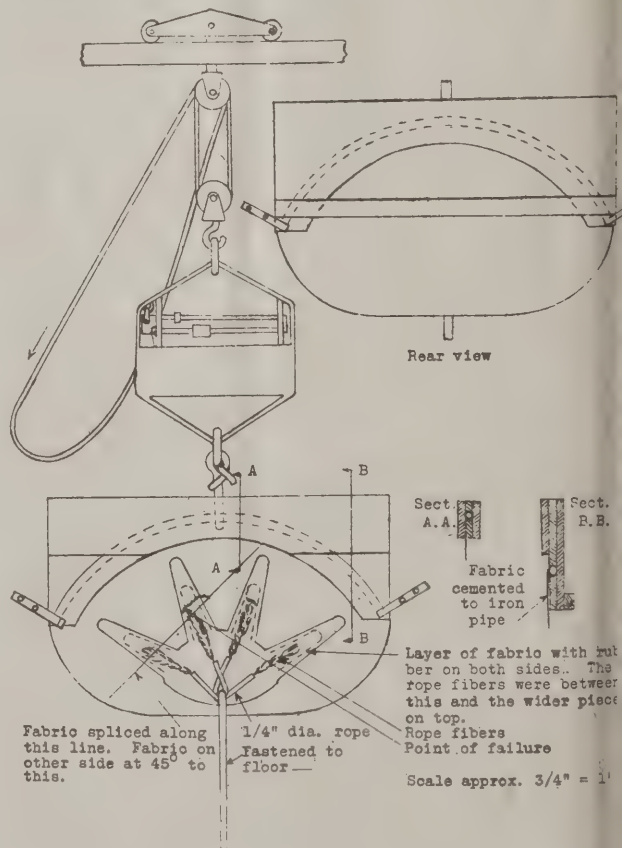
The entire apparatus was mounted on platform scales in order to determine the change in weight under the various conditions.

The pressures used were measured by manometer tubes, shown in the photographs, and were as follows:

Pressure of air (air filled).....	19½ in. water	
" " water (water filled).....	¼ " "	(approx)
" " air in forward ballonet.....	20 " "	
" " air in rear ballonet.....	20 " "	
" " air in both ballonets		
(used together).....	15 " "	

The pressure of the air when air-filled was made 19½ inches because about this pressure was necessary to straighten out wrinkles and give the model a fairly smooth appearance. It was assumed that the same pressure would hold the ballonet in shape, and hence it was used. Due to a leak in the connections when both ballonets were filled the pressure had dropped to 15 inches when the picture was taken. This was considerably in excess of the water pressure on the outside of the ballonets, hence they must have been completely filled in cases. One-quarter of an inch of water was used as this was the smallest amount that would indicate with certainty that the model was filled. A slight change in the air pressure occurred constantly, due to the cooling of the air after compression; also as a result of leaks, caused the water level to change slightly, requiring that a slight head be used to make sure the head did not become less than zero. Considering that the fabric in the model might take the form of that in the full-size airship, a quarter-inch head, equal to a probable increase of $\frac{1}{4}$ " in the vertical distance from top to bottom of the envelope was taken as zero head.

Correction for Readings on Cross-Section Paper.—The distance of the camera was kept at a constant distance of 200 inches from the screen, measured in the path of the light. As the distance from the axis of the model to either screen was 10 inches, the actual dimensions of the model may be determined



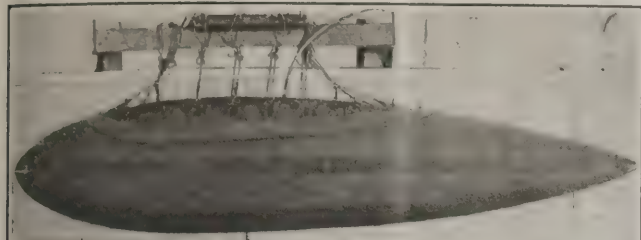


Fig. 3. Filled with air.



Fig. 4. Filled with water (not adjusted).

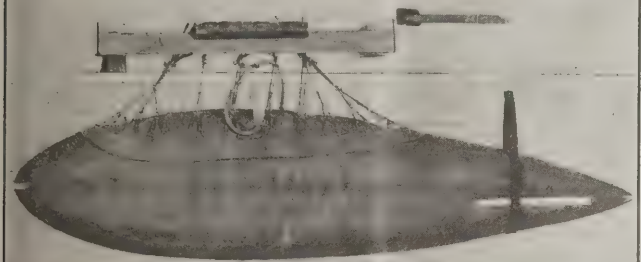


Fig. 5. Filled with water (adjusted).

which began to appear just under their upper ends and because tightening them threw the cords, which appeared in a vertical plane in the plan, more and more out of the vertical. The axis of the model was, however, straightened considerably in this way, as may be noted.

Forward Ballonet Filled With Air.—The principal effect of filling the forward ballonet with air, as shown in photograph, Fig. 6, was to tip the forward end up and to broaden it, the broadening being chiefly due to the increased tension in the cords holding the ballonet. The model at the same time moved forward as is shown by the increased inclination of the cords. Due to some peculiarity in the lighting, the liquid in the tube did not register clearly, but the pressure was about 20 inches of water. The tension in the rear vertical cords was increased, as is shown by the tendency to wrinkle on the sides under them.

Rear Ballonet Filled With Air.—Filling the rear ballonet with air, as shown in photograph, Fig. 7, had the same effect as that in photograph, Fig. 6, except that it was at the other end while the dent under the beam toward the rear end which disappeared in photograph, Fig. 6, reappeared here. The cords in the middle section swung to a vertical plane, those farthest forward taking the greater tension.

Both Ballonets Filled With Air.—In this condition, shown in photograph, Fig. 8, the axis was in nearly the same position as with both ballonets empty, except that the stern was higher by about 1½ inches. The cross-section at each end when the ballonet at that end was filled was of this form.

It was noted from a plan view that the filling of either of the ballonets with air distorted the stream line form considerably.

Force Exerted by Ballonets is of Proper Magnitude.—That the buoyancy of the air in the ballonets is of the proper magni-

tude, i. e., $\frac{1}{30.18}$ times the negative buoyancy of the ballonets

full-size airship, is evident from the following reasoning. A ballonet from the full-size airship immersed in water would have 909 times the buoyancy in the opposite direction, but the

ballonet in the model has $\frac{1}{909 \times 30.18}$ times the volume of the

(Continued on page 158)

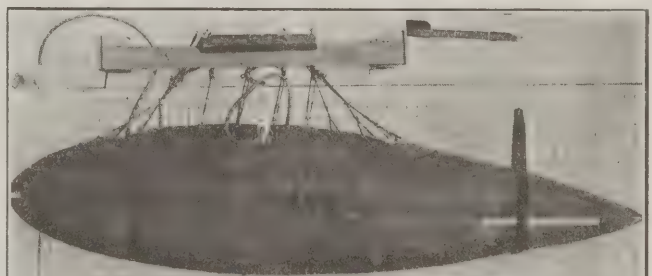


Fig. 6. Forward ballonet filled with air.

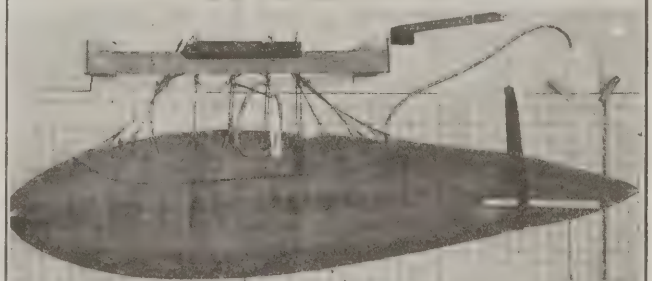


Fig. 7. Aft ballonet filled with air.



Fig. 8. Both ballonets filled with air.

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for any point on it by reading the dimension on the cross-section paper and reducing it by the ratio $\frac{200-9}{200} = .955$. If a

greater accuracy is desired, a correction for the inaccuracy of the paper should be made; the actual width being 19½ inches instead of 20 inches. The correction lengthwise will be by the same ratio, of course.

Discussion of Photographs

Filled With Air.—Fig. 3 shows the model filled with air and was the first one taken. The model had stood for several days filled with water, and it presents a much smoother appearance than when first filled with air before standing filled with water. It was found necessary in order to bring the model to a horizontal position to support nearly the entire weight by the cords furthest to the right to those which appear vertical in the side view. The other cords were drawn up as far as possible without causing any appreciable tension.

Filled With Water (not adjusted).—Fig. 4 shows the model filled with water, no adjustment of the cords having been made after taking the photograph, Fig. 3. It will be noted that the stern had sagged more than the prow and there was an off-set in the axis under the rear end of the belly band. The vertical cords toward the rear were too tight, causing a narrow section to show from a top view. It is not only the cords which took the weight when air-filled, however, that were too tight, as those just ahead of them appear equally stressed. The foremost of the cords passing through the rear ring caused an indentation and for this reason they were removed from the ring before the next picture was taken. The indentations around the ballonet valves were due to the fact that the cords attaching the ballonets to the envelope were too short. The wavy appearance of the sides was due to the seam and most of these waves did not extend much beyond the seam. The waves in the belly band took the form shown accidentally, and did not indicate that the cords would cause a similar form on the full-size airship.

Filled With Water (adjusted).—The following adjustments were made before taking photograph, Fig. 5. Numbering from the stern No. 3 cords were taken out of ring and adjusted, which caused the position of the ring to change. Nos 1 and 2 were taken up about 1 inch; No. 5 was let out about ¼ inch. The rear cords were not tightened more because of the wrinkle



Investment Value for Y May a

Ordnance Ma- terial In- cludes:



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Supplies; Tools;
Chemicals; Iron;
Steel; Copper;
Brass; Building Sup-
plies; Power Equip-
ment; Electrical Sup-
plies; Fr. and Br.
Tanks; Shell Cases;
Shrapnel Cases; Car-
tridge Cases; Shell
Boxes; Motors;
Pumps; Boilers;
Raw Materials, Mis-
cellaneous.

Quartermaster Material Includes:

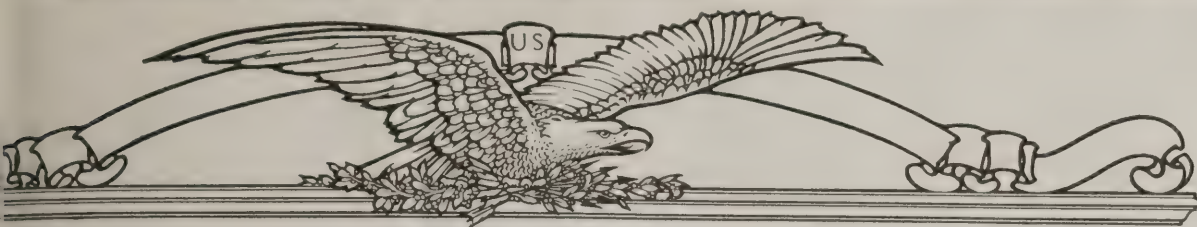


Clothing and
Equipage, compris-
ing: Underwear,
Socks, Shoes, Caps,
Gloves, Shirts,
Blankets, Sheets,
Towels, Bed Sacks,
Barrack Bags, Tex-
tiles; Subsistence;
Harness and Leath-
er; Vehicles; Hard-
ware; Mess Equip-
ment; Office Equip-
ment; Raw Ma-
terials; Miscellane-
ous.

This Buyer's Guide Points the Way

Date	Place	Sales Method	Materials Offered	Send for Catalog
May 2	Houston, Texas.....	Sealed bid...	J-1 Airplanes.....	Chief, M. D. & S vice, Room 2 Bldg., Washing
May 4	Rock Island, Ill.....	Sealed Bid...	Ord. Material.....	Salvage Officer, F senal, Ill.
May 4	Atlanta, Ga.....	Auction.....	Q. M. Supplies.....	C. O., Q. M. In Atlanta, Ga.
May 5	Buffalo, N.Y.....	Sealed Bid...	Lumber.....	Chief, M. D. & S vice, 2624 M Washington, D
May 8	Morrison, Va.....	Sealed Bid...	Airplane Hangars...	Chief, M. D. & S vice, Room 2 Bldg., Washing
May 9	Houston, Texas.....	Sealed bid...	Aero Engines.....	Chief, M. D. & S vice, Room 2 Bldg., Washing
May 9	Fairfield, Ohio.....	Sealed bid...	Castor Oil.....	Chief, M. D. & S vice, Room 2 Bldg., Washing
May 9	Jeffersonville, Ind....	Auction.....	Q. M. Supplies.....	Q. M. S. O., Gen. pot, 1819 W. Chicago, Ill.
May 10	Erie Proving Grounds	Auction.....	Ord. Material.....	C. O., Erie Pro Erie, Pa.
May 11	Chicago, Ill.....	Auction.....	Q. M. Supplies.....	Q. M. S. O., Gen. pot, 1819 W. Chicago, Ill.
May 16	New Cumberland, Pa.	Auction.....	Q. M. Supplies.....	Q. M. S. O., Gen. pot, 1st Ave. Brooklyn, N. Y.
May 18	Philadelphia, Pa.....	Auction.....	Q. M. Supplies.....	Q. M. S. O., Gen. pot, 1st Ave. Brooklyn, N. Y.
May 22	Nitro, West Va.....	Auction.....	Ord. Material.....	Charleston Indus Nitro, W. Va.
May 25	Atlanta, Ga.....	Auction.....	Q. M. Supplies.....	C. O. Q. M., In Candler Wareh Ga.
May 31	Brooklyn, N.Y.....	Auction.....	Q. M. Supplies.....	Q. M. S. O., Gen. pot, 1st Ave. Brooklyn, N. Y.
June 1	San Antonio, Tex....	Auction.....	Q. M. Supplies.....	Q. M. S. O., 8t Area Depot N Houston, Texa
June 6	McClellan, Ala.....	Auction.....	Q. M. Supplies.....	Commanding Offi M. Intermed. I Warehouse, At
June 8	Camp Jackson, S.C...	Auction.....	Q. M. Supplies.....	Commanding Offi M. Intermed. I Warehouse, At
June 13	Camp Grant, Ill.....	Auction.....	Q. M. Supplies.....	Q. M. S. O., Chic med. Depot, sh ing Rd., Chic
June 15	Chicago, Ill.....	Auction.....	Q. M. Supplies.....	Q. M. S. O., Chic med. Depot, sh ing Rd., Chic
June 19	Camp Sherman, O.....	Auction.....	Q. M. Supplies.....	Q. M. S. O., Chi termed. Depot, shing Rd., Chi
June 22	Boston, Mass.....	Auction.....	Q. M. Supplies.....	Commanding Offi M. Intermed. I Mass.
June 27	Norfolk, Va.....	Auction.....	Q. M. Supplies.....	Q. M. S. O., N med. Depot, I St., Brooklyn,
June 29	Brooklyn, N.Y.....	Auction.....	Q. M. Supplies.....	Q. M. S. O., N med. Depot, I St., Brooklyn,

WAR D E



the War Department's ine Sales

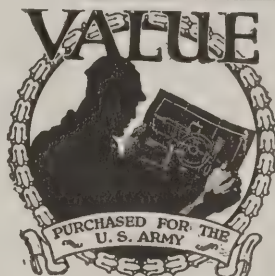
ale holds real investment VALUE for some-
To take advantage of the opportunities
by these sales there are several well de-
steps you should follow. First—Write for
s of sales that interest you. Second—Make
of the wide range of commodities listed.
those items on which you will want to bid.
Send your own representative, or instruct
one to act for you.

will see in the list of War Department Sales
ution and dates of sales of the various ma-
This outline will assist you in planning
advantage of those sales most important

For information regarding all War Department Sur-
property Sales, write:

MAJOR J. L. FRINK

Sales Promotion Section, Office of Director of Sales
25 MUNITIONS BUILDING, WASHINGTON, D. C.



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AIR SERVICE MATERIAL:

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pot, Buffalo, N. Y.; Long
Island Engine Plant, N.
Y.; Americus, Ga.; Rich-
mond, Va.; Morrison,
Va.; Montgomery Re-
pair Plant, Ala.; Chap-
man Field, Fla.; Carl-
strom Field, Fla.; Dorr
Field, Fla.; Park Field,
Tenn.; Selfridge Field,
Mich.; Fairfield, Ohio;
Love Field, Texas; Hous-
ton, Texas.

ORDNANCE MATERIAL:

Amatol Ordnance Re-
serve Depot, N. J.; Am-
atol Village, N. J.; Erie
Howitzer Plant, Erie,
Pa.; Picatinny Arsenal,
N. J.; Aberdeen Proving
Grounds, Maryland.

QUARTERMASTER SUPPLIES:

El Paso, Texas.

RTMENT

(Continued from page 158)
times the volume of the full-size airship ballonnet; hence the
force which it exerts is $909 \times \frac{1}{909 \times 30.18} = \frac{1}{30.18}$ times the
force exerted by the full-size airship ballonnet; hence the ratio
is the same as for the other forces.

Relation of Stresses in Model to Those in Full-Size Airship.

—The reason for making the model $\frac{1}{30.18}$ scale was that under

this condition the stress in the fabric when filled with water is equal to that in the full-size airship when filled with hydrogen. A proof of this is given in the note following the data. The weights of the hulls, however, act in opposite directions in the two cases. In the full-size airship it causes no tension on the cords and increases the tension in the fabric on the top. In the model the weight is taken by cords and the stress in the fabric just outside of the belly band is increased. This difference may be eliminated by placing a rubber tube filled with air inside the model. It was impossible to place this tube inside this model, however, without making an aperture in the envelope, which was not thought desirable nor necessary as the weight of the hull was very small compared with the weight of the water, whereas in the full-size airship it is much greater compared with the buoyancy.

Action When Partly Filled.—In order to obtain additional data to aid in deciding as to the pressure to be recommended, additional tests were made as follows: Water was drawn from the water-filled model with ballonets empty until the tail collapsed, due to the rudder and fin weight. This occurred when the level of water was about two inches below the inside edge of the belly band. To bring it to this level about 1/3 of the total weight of the water was drawn off. On the following day this part of the experiment was repeated at which time the level was brought 3½ inches below the inside edge of the belly band before a collapse occurred. This difference in results is explained by the fact that when the model is only partly filled it is in an unstable condition. If for any reason the water starts to run toward one end, that end becoming heavy sinks while the other rises, and the water rushes to the lower end. The first day that this part of the experiment was made, when a level of two inches below the inner edge of the belly band was reached, the water began to run forward and a collapse occurred. The second day it started to run in the opposite direction, a crease developing under the rear filling valve which became 1½ inches deep before the water began to run the other way and a collapse occurred.

Action of Rudder and Elevator Forces.—It was calculated that at 45 miles per hour and with the rudder at 30°, the force on the rudders for a model of this size would be about ¾ of a pound, and the force on the elevators would be approximately the same for this condition. However, as the other forces are 30.18 times those, correct to scale, for a model of this size, the rudder and elevator forces must be increased in the same ratio; hence a weight of 22½ pounds was used to represent the total pressure on the rudders, and the same weight was used to represent the total pressure on the elevators. The effect of hanging this weight on when with a head of ¼-inch (ballonets empty) was to deflect the stern about 8½ inches. When exerted sidewise the deflection was about one foot. Under a head of 10 inches the deflection was about 3½ inches down and five inches sidewise.

Action With Rudder and Fin Weights Removed.—A head of 10 inches was then put on the model, and the rudder and fin weights removed. The axis was not bent noticeably due to this removal, although the inclination was of course changed. The head was then decreased and the axis gradually bent until at one-inch head it had bent so that the stern was about five inches lower than with the 10-inch head, and it was also bent to the left about six inches and there was a fold in the fabric on the left side and bottom about 1¼ inches deep under the rear filling valve.

Change in Volume With Pressure.—Under the 10-inch head the weight was 483 pounds, an increase of about 4 per cent in net weight over that for ¼-inch head. However, there would be a much greater percentage increase in buoyancy in the full-size airship due to this increase in head.

Cross sections of the water-filled model with ¼-inch head are shown on Fig. 1. As previously stated these were obtained by bending a heavy fuse wire around the model. The tracing thus obtained was then reduced by the pantograph to the size shown in the figure. As noted above, the form when the ballonets were filled was with a valley on the under side. As this was due chiefly to the ballonnet cords being short and would not occur to the same degree in the full-size airship, no reproduction of the cross section, when the ballonets were filled, was made.

Conclusion.—From the above it appears that any pressure sufficient to keep the airship full may be used. No data was obtained which could be used to determine to what extent the wind would affect the deformation. But it appears that a pressure of one inch of water would provide a suitable factor of safety, and therefore this is the pressure recommended. Due to the negative buoyancy of the ballonets, a pressure of about 0.4 of an inch of water in excess of the pressure used on the hydrogen is necessary to equalize the pressure inside and out at the top of the ballonnet. This difference between the hydrogen and hydrogen pressures should be increased to probably at least ¾ of an inch to compensate for the weight of the ballonnet and for the tension on the cords.

DIMENSIONS OF MODEL		
	Condition	Dimensions in Inches
Length	Air filled.....	61.4
	Water filled, not adjusted.....	61.1
	Water filled, adjusted.....	61.0
	From specifications: $\frac{1}{30.18} \times 160 \times 12$	63.6
Maximum diameter	Air filled, actual.....	13.4
	From specifications: $\frac{1}{30.18} \times 31.5 \times 12$	12.5

WEIGHTS OF MODEL (Including Apparatus)			
How Filled	Pressure in Model	Pressure in Ballonets	Weight in Pounds
Air	19½"	None	311
Water	¾"	"	476
"	¾"	Forward, 20"	461
"	¾"	Rear, 20"	455
"	¾"	Both 15"	439
"	10" head	None	483
"	"	"	422 *
"	"	"	403 **

Short Proof That Stress in Fabric in Model Equals That in Full-Size Airship.—This proof is based on the fact that in a model made exactly to scale throughout, the stress per unit area, in any number, is the same as in a full-sized airship, if the pressure per unit area of the liquid remains unchanged at all points. This is the case, however, that the head of the water is rightly chosen, both pressures are the same function of the height. This necessitates in addition that the liquid used in the model have a greater buoyancy (positive or negative) than that used in the full-size airship, and if the thickness of

the fabric in the model be reduced by the ratio $\frac{1}{n}$, which is

the scale of the model, the buoyancy of the liquid used must be n times that of the hydrogen, but if it be not reduced, the

cross sectional area of the fabric in any plane is n times as

great as it should be to cause the desired stress with a fluid having a buoyancy n times that of hydrogen. Hence, in order

to cause the stress in the fabric of the model to equal that in the full-size airship, it is necessary to make the buoyancy of the liquid n times as great as it would be if the thickness of

the fabric were to scale. The ratio of the buoyancy of the liquid to be used, to the buoyancy of hydrogen, is therefore n². The ratio of the buoyancies of water and hydrogen

909. The scale to be used is then $\frac{1}{909} = \frac{1}{30.18}$. The negative

sign is not introduced in connection with the buoyancy of water

* At point of collapse, first trial; level of water 2 inches below inside edge of belly band.

** At point of collapse, second trial; level of water 3½ inches below inside edge of belly band.

Weight of water which model should hold, calculated from displacement given in specifications (77,000 cu. ft.) = $\frac{77,000 \times 62.4}{30.18^3} = 175$ pounds.

Weight of water actually held by model at 10-inch head = 483 lbs. 311 lbs. = 172 lbs.

(Continued on page 166)



The Beautiful Sky Below

The call of cloud-blown space may claim you,
Where sifting sunbeams set the world aglow.
The pall of the lonely void may awe you,
As drifting shadows cross the earth below.

The thrill of it all may wing you beyond
Where ages have bade man call a halt.
Its beauties may enhance your gift of gab,
Where lobbies hear you fly it to a fault.

But;
You and I, and the rest of the guild,
When the crate falls into a spin,
Think less of the beautiful sky above
Than what's left of the sky we're spinning in.

So, the azure dome and its infinite span
Are yours (things O. K.) for mind's romance.
Yet, you'll glory more in the last few feet,
When you've just won out on a long shot chance.

A. A. C.

Why Pick on Aeroplanes?

Every month there are thousands killed, by automobiles,
These days it happens so often, that we take it like our meals.
Railroads mangle & kill, their victims by the score,
'Tis such a common occurrence, we don't mind it anymore.
Constantly by the street cars, there are scores killed,
They jump the track & smack one black, keeping hospitals filled.

The news "paupers" bought & supported, by these two industries,
Say scarce a word of all these things, for fear of getting a freeze.

A short time ago a foreign balloon, not an AEROPLANE,
Blew up & the papers of the world, chucked it in every brain.
On a basis of passengers carried, & actual miles flown,
'Tween autos & planes for safety, the Planes take the bone.
Statistics have been handed, to the shyster newspapers,
And they refused to publish them, specially the auto's capers.
But let an accident happen, to an Aeroplane,
The newspapers of the world, shout it in loud refrain.
Because 'tis such a scarce thing, & also such good news,
To bring to them from the public, all their coppers loose.
From railroads & auto manufacturers, it also brings fat dues,
Just like the old proverbial, the golden egg'd goose.

H. T. HALLER.

Clouds

By CONTACT

As I go thru the sapphire ways of the air
And over the mosaic maps below,
My thoughts often turn to the clouds floating by
And I wonder at them as they come and go.

Their fleecy shapes of silver white
I see on days so fair.
These faithful wanderers of the sky
Are my companions of the air.

And along thru the endless trails of space,
The snowy shapes go floating by
Slowly, peacefully, undisturbed
Save for my plane that roars on high.

Then, oft I have seen them as peaceful sheep
In the pathless meadows of the sky.
And have lightly touched their curving shapes,
In the course of my flights which have carried me high.

And before me I've seen them in one sullen mass
As if to bar me and my powerful flight!
Then I immerse my ship in their misty shapes
And find myself lost in a sea of white.

Between, above and below the wings
Come ghostly opals in lazy flight
Blown by the four winds of the sky
On thru the day and on thru the night.

Will You Remember?

1

Heart of gold, before the sun is high
And a plane travels through the golden sky
While the sun from east, with golden gleam
Goldens your house, mountain and stream.
From up high small appear human dens,
And morning peace thralls the souls of men—
Heart of gold! do you remember then?"

2

And when you see a plane high in eastward flight,
And thunderstorms darken day into night,
When lightning forces its way to ground
And everything toward shelter is bound,
When a bolt will light up cattle and pen
And ghostly fears will shroud the souls of men—
Heart of gold! will you remember then?

3

When sometimes you'll see a drowsy sky
Remember the flight we had, you and I?
We were flying over those mountains and trees
It must still live in your memories—
The cattle were grazing behind the pen
And peace went into the souls of men—
Heart of gold! will you remember then?

B. K. R.

The Call

Do you ever have a longing to get in the air again
And to face the same old dangers like a reg'lar flying man?
Do you ever have a yearning just to try your luck once more
Rather facing thunder and lightning than to be inside that door?
Do you ever sort of hanker for a rough and ready trip,
Just to prove you're still a living and you haven't lost your grip?
Do you ever get a feeling being cramped and useless here,
Making figgers while you shine your pants upon an office chair?
Do you ever pass a paintshop, and so get the smell of dope?
Know the time that you were trying getting it off your hands with soap?
Do you ever pass a field; getting the castor oil odor,
Don't you wish to have the stick in hand and a roaring motor?
Don't you ever wish to be back just for one more flight,
Just once more in the game again and a real aerial sight,
If not for any particular reasons, give your friends the laugh
And so show the roaring element that you still can stand the gaff.
If you don't, then heaven help you and you sure are dying then,
You might once have been a pilot but never a flying man.

B. K. R.

Johnny: "The camel can go eight days without water."
Freddy: "So could I if ma would let me."

Winner at a Glance

Algy: That vulgah puhson mistook me for a racing man.
Sally: How was that?
Algy: He said I won the Brown Derby.—Stanford Chaparral.

"Cheese, sir?" inquired the waiter.
"Certainly," replied Besse. "Catch me a Limberger!"
The waiter made a grab at the sideboard and seized one in the nick of time.
"Now catch me a Gorgonzola!" said Besse.
Grappling with it violently, the waiter brought it over.
"Now," said Besse, "let 'em race across the table to me and I'll take the winner."



FOREIGN NEWS



Laws and Regulations Governing Aerial Navigation in Italy

The Division of Civil Activities of the Office of the Chief of Air Service from time to time will publish bulletins on the laws, regulations and provisions governing aerial navigation in Italy. The object of this publication is to furnish to all persons and companies interested in aerial navigation the laws and regulations governing this matter that are in force at the present time.

The following is a translation of Circular 0005322, establishing the rules for the employment of the term "Air Route" for telegrams and phonograms:

For the purpose of insuring continuous communication between air ports, in the transmission of news relating to the movements of air-craft, in compliance with the agreement made between the Ministry of War and the Ministry of Post and Telegraphs, the latter, on special behalf of air navigation, has allowed the form "Air Route"—already in use for telephone communications—to be extended also to State telegrams which, therefore, will enjoy the absolute precedence over all other telegraphic correspondence.

1. The term "Air Route" shall be used for communicating only the departure or arrival of air-craft, convey news to the interested Headquarters concerning important incidents to air-craft during their journey (landing outside their stations), to communicate important meteorological information in connection with air navigation, calls for assistance, etc.

2. All notices regarding the movements of air-craft in navigation shall be transmitted by telephone which shall be considered as the most preferred, quickest, and normal means of communication. Therefore, a telegram bearing the wording "Air Route" shall not be transmitted except when it has not been possible to convey the communication by telephone.

3. The permission to use the form "Air Route" in telegraph and telephone communications is granted only to the regular commanders of air posts, fields, repair depots, naval air stations and, during their absence, only to those persons designated by them.

4. The permission referred to in the above paragraph is extended to the Commanding Officers of the Royal Carabinieri when they must convey information regarding the landing of air-craft outside their field. In such cases the form "Air Route" shall be used only for the transmission of telegrams to the air port interested in the case, as the communications to other offices must be transmitted by the ordinary means.

5. The same permission is granted to corporations or private parties engaged in aerial navigation. Such concession is, however, subject to the following conditions:

a. To possess the Ministerial Decree conferring the right to carry on aerial navigation services;

b. To carry out such right on private fields, their own property, and when duly authorized, and when there is no governmental representative, for in this case the permission is granted only to the latter;

c. To have requested (on stamped paper of Lire 2) and obtained a written authorization from the Ministry of War (Comando Superiore di Aeronautica—Division of Civil Activities) which will, if necessary, notify the Ministry of Posts and Telegraphs and the Telegraph and Telephone Office having jurisdiction over the territory wherein the field is located;

d. To pay from time to time the relative fee for urgent telegrams and phonograms;

e. That in their application they will make a declaration of their readiness to pay the fines mentioned in the Concession for using air-craft, also for every non-compliance with the rules of this circular.

6. The rare and rational use of the form "Air Route" shall be exercised with the utmost scruple, so that the permission granted may not generate into an abuse but remain in the very strict limits allowed.

7. In every air port, field, depot, naval air station, there shall be kept a special register for telephone correspondence or telegraph communications transmitted with the wording "Air Route." Such record book shall contain the progressive number, date, hour of the communication requested, the hour in which the communication has been granted, the address and the text of the telegram or phonogram, references, name of the employees who transmit or receive the communication.

On such record book the text of the telegram or phonogram shall be written and signed by the same parties to whom the concession has been granted.

8. Any abuse whatever in the use of the form "Air Route" will be punished by disciplinary measures and the payment of the expense, if the abuse is committed by a Government Official; by a fine, as referred to in Art. 5, (6) and by the immediate revocation of the concession in case of private corporations.

Italian Aeronautics

In order to establish more rapid communications between Italy and Tripolitania, the Secretary of the Colonies, Hon. Girardini, is endeavoring to organize an aerial mail service from Rome to Tripoli that may eventually be used also for the transportation of passengers. In this way the Superior Command of Aeronautics, which is occupied by every interest in the technical side of the problem, has granted the use of the magnificent dirigible "Esperia" to make its first flight, which will take place in the coming Spring. In the meantime, while they are completing certain works in order to prepare the aeroplane for her flight, her commandant, Maj. Velle, will go to Tripoli personally to make sure of a safe landing.

Meanwhile, the Assistant Secretary of the Colonies, Hon. Verino, has inspected the dirigible "Esperia" at the port of Ciampino. She was built especially for the civil service, and besides carrying a load of mail she may also carry twenty passengers, each with 55 lbs. of baggage, on a long trip, offering them the accommodations of a railway parlor car.

Following the votes expressed by the Aero Club of Naples, through its General Secretary, Mr. Maisto, in the recent meeting of Directive Council of the National Aeronautical Federation in Rome, the International Aeronautical Federation at its last meeting in Paris has decided that the International Race for the "Trophy of the Sea Aviation, Jacques Schneider," will take place in Naples in the latter part of August. The great race will be part of an International Week of Hydro-Aviation, which will embrace also the contests for the "Great Trophy of the Tirrenean Sea" (created by the Superior Command of Aeronautics) over a circuit of 1,260 miles touching several ports of

Sicily. Prizes aggregating about 300,000 lire will be awarded to the winners of the various events.

Spanish Appropriations

A Reuter dispatch from Madrid states that the Spanish Minister of War has submitted to the Cabinet a proposal providing for the appropriation of 175,000,000 pesetas for the creation of an aer force of 10 squadrons, consisting each of 18 machines of average size and of six "giant" machines for bombing purposes.

Night Flying Express

The first air express to be fully equipped for night flying left the London Air Station for Paris recently. This machine, the Farman Goliath "Verdun", with accommodations for thirteen passengers, is used regularly now by the Grands Express Aeriens on their daily service between London and Paris. In addition to softly shaded lights in the saloon, red and green electric navigation lights are fixed on the extreme tips of the wings, and a bright rear light is fitted to the tail. Two powerful electric searchlights are placed in the center of the machine below the passenger cabin, and light up the ground over which the aeroplane is flying. The electricity for all this lighting is supplied by two dynamos, which are driven by tiny windmills rotating rapidly in the wind produced by the aeroplane as it rushes through the air. Four powerful magnesium flares are suspended in pairs below each lower wing tip, and the pilot lights these by electricity as he approaches the ground, thus making landing at night an easy operation.

Production in Germany

The work of disarming Germany in the air is ended, according to a correspondent of the London *Daily Mail*. All but 20 of the British, French, Italian, Belgian, and Japanese officers, who have worked under General Masterman on the Inter-Allied Commission of Aeronautical Control, have left Germany. On May 5th the Commission will cease to exist.

Since January, 1920, when General Masterman arrived in Germany, the Commission has destroyed 14,800 airplanes. Of 29,500 motors dealt with, some have been handed over to the Allies, but most of them have been destroyed. Six airships have been handed over to the Allies.

The work of the Commission has been done under great difficulties; never before had the work of disarming a nation been undertaken. When General Masterman demanded a list of places where sheds, works, and airplanes were to be found, the authorities declared that the papers had been lost during the revolution. Only little by little was the necessary information collected.

General Masterman's work is ended, but the control of civil aviation in Germany is to continue. The Council of Ambassadors has not yet published the regulations to be imposed. It is certain that there will be a small permanent Commission with the right of inspection to see that manufacture is carried out within the lines to be prescribed for future German aircraft.

Aerial Touring in North Africa

The first pleasure tour by air across French North Africa, according to Mr. Edward A. Dow, American Consul at Algiers, Algeria, has been undertaken by Mr. Lucien Sharp, of Providence, R. I., an American citizen, now residing temporarily in Paris. Mr. Sharp came by air from Europe to Casablanca, making the journey from that point to Marrakech, Morocco, thence to Oudja. From the latter point he came directly to Algiers, arriving there January 28th. On January 30th he proceeded to the border of the Sahara Desert at Biskra and Touggourt, and intends continuing his journey by air to Constantine, in Algeria, Tunis, thence to Sicily, Rome, Athens, Constantinople and Western Europe.

The voyage was undertaken in a De Havilland (English) Biplane, and the pilot is an Englishman, Mr. Alan Cobham. There is said to be space for only three persons in all.

Military aviation is being studied in French North Africa. New posts have been established in the interior of Algeria, at Hassi-ba-ba and Laghouat, each about 165 miles from Algiers.

It is proposed in France to endeavor soon to establish aerial tour from Algiers to the desert at Biskra and Touggourt, and another cross-country line from Gabs and Tunis, in Tunisia, to Algiers; thence to Oran, Algeria, and Casablanca and Agadir, in Morocco.

A German dirigible "Nordstern" was recently turned over to the French Government, and after repairs have been made, and stations built, it may be placed in operation between Marseilles and Algiers.

Policing Iraq by Aircraft

Sir Percy Cox, High Commissioner of Iraq, made his first inspection by air of part of the country lying along the Euphrates on March 21, when he visited Fahad Beg Ibn Radhdhal, Sheikh of Amarat, at his headquarters, about 30 miles N.W. of Hit. He was accompanied by his staff and a Royal Air Force guard of honor.

The party, we learn officially, left Baghdad in three Vickers "Vernon" machines, one of which also carried stores for armored cars, with an air escort of 12 machines.

The Amarat, who are well armed and number 5,000 rifles, range the eastern half of the Hamad as far north as Dair az Zaur. The tribe is regarded as friendly to the British. The effect of the visit and the demonstration of air power by the assembled aircraft, and of machine-gun fire by armored cars, which were also present, is reported to have been very impressive. The flight, which covered about 300 miles out and home, partly following the course of the Baghdad-Cairo air line, was accomplished successfully on the day of the inspection, by the 15 machines engaged.

The Vickers "Vernon" machines which were used for conveying the official party are twin-engined troop-carrying aeroplanes that have been sent recently to Iraq to augment the air units stationed there, and are destined to take an important part in the garrisoning of this vast territory when it comes entirely under Royal Air Force control.

The machine is capable of carrying a load of nearly two tons, and can accommodate 12 persons, with full military equipment, in addition to the pilots, water, and food supplies.

ELEMENTARY AERONAUTICS and MODEL NOTES

Kite Flying

THE behavior of kites is certainly very puzzling to those who do not thoroughly understand the subject. A kite may be made with the greatest degree of perfection, and placed in the hands of one of considerable experience; nevertheless, it may behave very badly, diving suddenly to the ground without any apparent reason. Then, again, this same kite will sometimes steadily mount in the air until it reaches a height difficult to account for.

If the surface of the earth were perfectly smooth, and the wind should always blow in a horizontal direction, kites would not show these eccentric peculiarities, but as a matter of fact, the air seldom moves in a horizontal direction; it is always influenced by the heat of the surface of the earth.

Heated air is continually ascending in some places only to be cooled and to descend in other places. If one is attempting to fly a kite where the air is moving downwards, he will find it an extremely difficult matter, whereas, if he is fortunate enough to strike a current of air which is rising, the kite will mount much higher in the air.

Kites sometimes rise upwards and continue moving into the wind until they pass directly over the spot where they are attached to the earth. It is only on rare occasions, however, that a wind is found to be blowing at a sufficiently sharp upward trend to cause a kite to fly at such an angle. As the center of the upward current is constantly moving, it is certain that very soon it will move away from the point from which the kite is being flown.

An example of the force of rising air currents is seen in the following observations made by a noted scientist during the burning of a large warehouse in New York many years ago. The wind was blowing a gale through all the streets leading in the direction of the fire, although it was quite calm everywhere else. The flames mounted straight in the air to an enormous height, taking with them a large amount of burning wood. At a point fully 500 feet from the fire a piece of partly burned 1-inch board 8 inches wide and 4 feet long, fell through the air. This board had evidently been taken up to a great height by the tremendous uprush of air caused by the hot fire. It is very evident that a kite made of boiler iron could have been successfully flown under these conditions, providing that it could have been brought into the right position.

Model Photographs Wanted

AERIAL AGE wishes to obtain a photograph of the Orenco Fighter model, plans of which were published in the March 4, 1921, issue. Anyone having built a model from these plans, who will send in a clear photograph of it that can be used for publication, will receive in return for it a large sized professional photograph of a well known man-carrying aeroplane.

To the first one sending in a clear photograph of the Curtiss Navy Racer model, described recently, will be sent by return mail a large photograph of the real machine.

Fifteen H. P. Sled Travels 80 Miles an Hour

The motor-propelled ice sled illustrated in the photographs below, is of the latest design by E. J. Andries, 283 East Grand Boulevard, Detroit, Mich. The Andries "Air Sled" was operated for the first time last month on Lake St. Clair. The great interest in this sport is shown by the increasing number of air sleds which have made their appearance on the lake in the past two years.

The body, patterned after the conventional aeroplane fuselage, is made entirely of wood, fibre and aluminum, screwed and bolted to five bulkheads. Steering is accomplished entirely by means of an air rudder, balanced above a short vertical fin and operated by a foot-bar.

A tail skid is provided which comes into play only when excessively rough spots are encountered. The body is fourteen feet in length and weighs 250 pounds. An instrument board carries all motor controls.

Although it is powered only with a 12 to 15 horsepower motor, it is capable of a speed of eighty miles an hour.

Racing Auto Makes High Speed

As far as American aeroplane speed records go, automobiles have the lead on aeroplanes, in one-mile stretches at least. The world's speed record for automobiles has been smashed by Sig Haugdahl, a Norwegian driver, early in April of this year. He negotiated a mile at Daytona Beach, Florida, in 19.97 seconds, slipping 3.1 seconds from the previous record, held by Tommy Milton. Haugdahl's performance gives him a rate of 180.27 miles an hour, which is over 3 miles an hour faster than the Curtiss Navy Racer. It must be remembered, however, that the Navy Racer at times travelled at a much greater speed than this, and that the speed of 177 miles is the average for the entire circuit during the Pulitzer Trophy Race.

Exhibition Model Built by Aerial Age Reader

Several stores in Toledo have displayed the 30-inch exhibition model designed and built by Wilbur J. McKenna, of 115 E. Woodruff Avenue, Toledo, Ohio. Although it was his first attempt at anything of this kind, the model is a very neat piece of work, and attracts many people to view it in the store windows.

The outline does not follow any particular design, but all the conventional parts are arranged as on the average aeroplane. It is equipped with a small 110-volt electric fan motor which drives a propeller 6 inches in diameter. The fuselage is covered with metal over an orange wood framework. Struts are made of copper tubing. Wings are solid wood. The landing gear is provided with rubber-tired disk wheels.

A full set of controls is installed in the cockpit. There are also electric lights and two-speed control lever which regulates the speed of motor.

A 15 H.P. motor-cycle engine drives the Andries Air Sled 80 miles an hour





RADIO DIGEST



Flying Parson's Plane Broadcasts Concert

A radio concert several thousand feet above the earth was broadcasted April 14 as an aeroplane piloted by Lieut. B. W. Maynard, the "flying parson," flew over New York City. The stunt was for the benefit of the fund for a veterans' mountain camp in the Adirondacks, of which Lieut. Maynard is campaign director.

The second flight of the plane was made at 3 o'clock on Sunday, April 16, when Lieut. Maynard preached a sermon from the clouds.

Radio Expert Addresses Aeronautic Executives

One of the largest groups of Aeronautic Executives attended their sixth semi-monthly luncheon at the Café Boulevard, Friday, April 7th.

The speaker, Mr. Jack Binns, Radio Editor of the New York Tribune and the Popular Science Monthly, was introduced to those present by Chairman R. R. Blythe, who in his introduction stated that Mr. Binns, besides being known all over the world as the hero of the sinking of the S. S. Republic, was perhaps one of the best informed men of the use of wireless and radio for aircraft.

Mr. Binns is opening his address pointed out the necessity of equipping all passenger carrying aircraft, operating between two cities, with radio.

"I was asked the other day," he said, "why it was that commercial aviation could not develop overnight, as had radio. My questioner evidently did not know that radio experiments and developments have been going on for the past twenty years and this so-called radio craze is nothing more or less than the result of these years of pioneering effort. Radio on aircraft can serve two purposes. First, it will allow pilots by means of directional instruments to keep on their course, and make a safe landing through fog and heavy weather. Secondly, it will permit communication from the land telephone, via radio, to passengers on aircraft in flight."

Mr. Binns referred to the loss of the independently owned flying boat "Miss Miami" with its toll of five deaths. It was his opinion that these lives could have been saved if a radio set had been on the ship.

In closing, Mr. Binns urged that operators of commercial aircraft particularly the larger companies, should without delay equip each of their planes with radio apparatus. Even if the initial cost was high, one accident would prove the wisdom of such installation.

At the close of the luncheon Mr. Blythe read the text of a resolution calling on the Contest Committee of the Aero Club of America to settle the controversy in regard to the award of the Larsen Trophy, which arose at the Omaha Air Meet last fall. This resolution was signed by all the Aeronautic Executives present, which completed a representation from every reputable aircraft company in the east.

New Amplifier Gives Quality with Volume

Amplification of voice waves, giving the original true quality, increased many thousandfold in volume without a corresponding increase in the distortion caused by reproductions, is the latest progressive step in the development of wireless telephony.

This has just recently been accomplished by the use of the newly marketed two-stage amplifier and loud speaking receiver of the Western Electric Company. Leading New York dealers in radio apparatus witnessed the first demonstration of the device recently.

The machine proved its worth beyond the highest expectations of the engineers.

Harry Goldman, of the Aldan Accessory Company, was among the first to appreciate the possibilities of the perfected device, and immediately asked for the first supply to be given distributors.

Explaining the two-stage amplifier and loud speaker, the details of which he made public for the first time, Mr. Goldman said:

"The new Western Electric two-stage amplifier is a masterpiece. It is a two-stage amplifier, three-tube, with two tubes used in the last stage, the last two tubes controlled by 'push-pull' switch. The first bulb is also an amplifying tube.

It succeeds where other amplifiers and loud speakers fail, in that it amplifies ordinary speech and voice currents, keeping their exact tone and quality even when increased 200,000 times, without the usual added distortion.

"To explain it in lay language, if a solo by Galli-Curci is being transmitted, her voice, though increased in volume thousands of times, retains the distinctive characteristics of her particular voice. Whereas ordinarily it would come in as some high soprano, hardly distinguishable from that of any other concert star, the Western Electric amplifier and loud speaker receives it so that it is distinguishably Galli-Curci's voice.

"Here is another way of putting it. When a man speaks in an ordinary conversational tone, his voice is distinctive and natural, yet when he shouts it increases in volume but loses its quality, often cracks. The Western Electric two-stage amplifier, on the other hand, takes the ordinary voice, magnifies it, expands it to what would relatively be a gigantic shout, yet does not 'flatten' it or destroy its tone values.

"Heretofore every effort to do this has resulted in increased distortion.

"The instrument is the same which was used at Madison Square Garden in receiving President Harding's address, and two years ago, when the company's engineers were experimenting with it, Cornell men, speaking into an ordinary telephone receiver, connected with the amplifier placed on the roof of the West street building, spoke to the Aquitania sailing down the bay with the Cornell cross-country team aboard. The Aquitania answered with radio.

"I really believe that it is one of the greatest practical advancements which have been made in the science, as it has already proved its worth and adaptability to ordinary commercial usage."

Easy for Novice to Hear Broadcasts

To the novice, trembling on the verge of entry into the radio world, the aerial is the most formidable of the obstacles to be surmounted before the sweet strains of W J Z enter his ears by way of his own set.

The greatness of the difficulties which he must overcome depends upon many and varied things. If he is an apartment dweller, the temperament of his landlord, the shape and height of the roof, and the nearness of power lines or telephone wires all enter into the matter. If he is a suburbanite, the length of his backyard, the nearness of big trees, and the need for a tower or some other support, preferably higher than the house end of his antenna, all enter into the matter.

The radio amateur who desires only to listen to the broadcasts sent out by Newark, Pittsburgh, Springfield or Medford Hillside, need not lose too much sleep and hair over his problem, for all he needs is a single stand of wire, preferably between 175 and 200 feet long, of copper, phosphor-bronze, or aluminum, slung at from thirty to fifty feet above the earth.

A somewhat more elaborate antenna is needed by the novice who hopes some time to go into the sending end of the game, but these are not so terrifically difficult as they may seem after listening to the chatter of expert amateurs.

Three types of antenna, the inverted L, the T and the umbrella, which are sufficiently efficient for the work contemplated.

The first of these, much used on ships, is called the inverted L, because the lead-in from the four strands composing it is from one end, giving the appearance of an L with its toe pointing earthward. If you desire to receive one station particularly well—Newark, for example—the aerial should point in that direction, with the lead-in to the apparatus indoors from the nearest end of the station. This type is particularly effective in receiving long wave stations. The length of the aerial should not exceed 100 feet, as in sending a longer aerial would give a natural wave length above the 200 meters at present permitted to amateurs.

The second type, the T, is much like the inverted L, for it consists of four wires suspended in the same plane. The lead-in to the set in the case of the T, however, is directly in the center of the span. The amateur must take care to get the precise center if he hopes to secure the maximum efficiency of his aerial.

The T type should not be longer than 135 feet, and neither of these aerials, if used for transmitting, should be higher than thirty-five feet. Otherwise the natural wave length will exceed the present 200 meters permitted. In the use of this aerial the amateur will discover that the waves come in strongest from stations which are in line with the length of the antenna.

The third type of aerial, the umbrella is more or less of a makeshift, designed for use where the spanning space is not sufficient for either the inverted L or T aerial. This type receives or transmits

waves equally well in all directions, but is not a very good radiator in any direction. It consists of a pole or mast, from which four wires stretch downward and outward. The lead in this case is from the upper end of these wires, which are, of course, carefully insulated from both the pole and the stakes at the foot, holding the antenna wires.

There is nothing particularly mysterious about the aerial or its insulation. The object of the aerial is to intercept feeble radio waves. These waves induce in it a current of feeble voltage, but of high frequency oscillation. Naturally this wire should be a good conductor and should be insulated from its supports, so that the whole energy of the current may be led to the receiving apparatus which is to translate it into sound, slight or great, according to the apparatus. Greater care in insulation should be taken if the aerial is to be used for transmission.

The insulators may be purchased, if other amateurs have not already cleaned out the nearby stores, or ordinary electrical light wire porcelain cleats may be used. The lead-in must also be carefully insulated and should be kept clear of all obstructions.

The lead-in should be brought down by a knife blade switch which may direct the current either to the set or through an outdoor connection to the ground. This switch should be thrown to send the current on the latter path when not in use during thunderstorms. The radio instruments inside the house should be connected permanently to a ground, preferably to a water pipe, by ground clamps. A radiator or a gas pipe may also be used as a ground. —N. Y. Herald.

The Brooklyn Show

Several interesting contests that will appeal strongly to amateur fans are being planned for the first annual radio and electrical exhibition of the Electrical Contractors Association of Brooklyn and Queens to be held in the Brooklyn Ice Palace, starting May 6 and lasting two weeks.

One will be a contest for the Brooklyn Council of the Boy Scouts of America. The Boy Scouts are exceptionally enthusiastic radio fans, so the contest is sure to create unusual interest. In all probability prizes will be offered for the best receiving set constructed by a Boy Scout. Also another prize for the smallest set exhibited.

The Crocker-Wheeler Co., of Ampere, N. J., has given the Brooklyn Contractors a motor generator for the operation and transmission. These are the motors used by the United States Government on its aircraft and ships. The motor will be seen working at the show and at the end of the exhibition, it will be awarded as a prize in another amateur competition.

There is being built on the roof of the Ice Palace, located at the corner of Atlantic and Bedford Avenues, a 2,400 foot antenna. It will be the longest in the city. The antenna will be used for receiving and sending messages during the exhibition.

It is planned to have Mayor Hylan open the show. He will do it by radio either by sending his opening message from the exhibition or sending it from a broadcasting station so that it may be picked up and heard by all at the opening of the show.

Uses for Radio Outside of Entertainment Are Cropping Up Steadily

Aside from the entertainment features of radio, many new uses are being found

for this comparatively new development. Recently, persons on the streets of one of our large cities were astounded to see an automobile unoccupied, and apparently undirected, proceeding under its own power through the traffic, uncannily stopping, starting, turning out, honking its horn, and acting precisely as if guided by an invisible driver. And so it was, the real driver being in another car some distance away and directing it by wireless.

The same application can be made to boats and to airplanes, and progressive fire chiefs are experimenting to determine the possibilities of controlling fire-fighting apparatus by some similar method which will lessen the danger to firemen, and make it possible to place the fire apparatus closer to the vulnerable points in the conflagration.

Among those endeavoring to find wider uses for wireless are Assistant Fire Chief James E. Granger of Cleveland, Ohio; Chief Moran of the Hartford (Conn.) Fire Department, and Superintendent Garrett of the fire-alarm signal department of Dallas, Texas.

Superintendent Garrett has a radio receiving set installed in his automobile, and by this means is kept informed of every fire alarm, no matter where he may be at the time.

During the recent primary election in Pittsburgh the principal candidates gave short addresses over the radiophone, this being the first instance of its use for such a purpose.

When Gypsy Smith, the great evangelist, was holding a series of meetings in conjunction with the forty-eight Pittsburgh churches, these services were broadcast over the radiophone by K. D. K. A. An enterprising publicity man installed a radiophone in the Gypsy's apartments at the Schenley Hotel, and, surprised him with the phonographic production of his own voice from the radio station, seven miles distant, and also the singing of his own choir of over a thousand voices from the Motor Square Garden, two miles away.

Radio Corporation Offers Statement on Supply Situation

The question of radio supplies agitates a great many people at present, since so many of the radio enthusiasts often find it impossible to satisfy their simplest needs. The cause is, of course, the totally unexpected size of the demand for such equipment and the inadequate preparation for supplying it under which the manufacturers all labor. The following official statement by the Radio Corporation of America is of timely interest, implying as it does that that company and its associates are in the midst of a manufacturing programme which will not cease until the necessary apparatus is readily available. The statement is signed by E. E. Bucher, sales manager of the corporation:

"The Radio Corporation of America is endeavoring in every way possible to meet the unprecedented demand for radio devices, including vacuum tubes, broadcasting receivers, and other equipment, which has recently met with much response, not only on the part of the amateur and experimenter, but also on the part of a great many people who are interested to equip their homes with suitable radio telephone devices for receiving music, concerts, lectures, and other interesting features transmitted from radio telephone broadcasting stations.

"The factories of the General Electric Company and of the Westinghouse Electric

and Manufacturing Company, which are manufacturing such devices for the Radio Corporation of America, are now operating on a greatly expanded production programme, and it is expected that within the next few weeks considerable quantities of material will be shipped to us on orders already placed with the factories by the Radio Corporation. These will be delivered to our customers as rapidly as received in the warehouse.

"Distributors are requested to communicate the above information to dealers, and to inform them that orders will be filled by us just as promptly as possible. This applies to all classes of radio apparatus for which we are accepting orders, including radiotrons, vacuum tubes, etc., which are employed for reception.

We believe that radio broadcasting is here to stay. The great opportunities for the sale of radio devices can, in our judgment, only be properly taken advantage of if all those who are interested in distributing and selling this apparatus properly equip themselves to handle this class of merchandise in a satisfactory way. This means that the dealer, or whoever is effecting the sale to the consumer, must familiarize himself with the product, explain its capabilities as well as its limitations, and lend assistance in every way toward the proper installation and maintenance of radio sets.

"Those who desire radio equipment and cannot for the moment obtain it, should be informed that the present shortage is but temporary, and due entirely to the great demand which suddenly came as a result of broadcasting, and that the Radio Corporation and its associates, the General Electric Company and the Westinghouse Electric and Manufacturing Company, are doing everything in their power to produce the necessary apparatus with maximum speed; that normal production is expected to begin within the next few weeks, and that deliveries will then be promptly made.

"A new catalogue covering all of the radio devices being manufactured for the Radio Corporation of America by the General Electric Company and the Westinghouse Electric and Manufacturing Company is now in course of preparation, and it is expected that it will be available for distribution within thirty to forty days from date. This catalogue will contain information of value to the wholesale distributor, the retail dealer, and the ultimate user of radio apparatus.

"We solicit your co-operation, and at the same time ask your indulgence until we have obtained factory production which will enable us to meet the demand."

Radio on Mail Planes

One of the big air mail ships came over from Chicago to Washington April 15 in the flying time of 6 hours and 2 minutes, piloted by E. Hamilton Lee. The mileage was 715 miles, which averaged 119 miles per hour. This ship came here for the purpose of having installed as a part of its equipment the radio sending and receiving telephones. This is the first of the transcontinental ships to be equipped with this wireless telephone outfit. It is expected to equip all of the air mail ships with these instruments. The radius is 200 miles. With this wireless telephone equipment attached to the airships the pilot will be in constant touch with the station just left and the one to which he is flying. There will also be a range finder to locate the station toward which he is flying during foggy and stormy weather.

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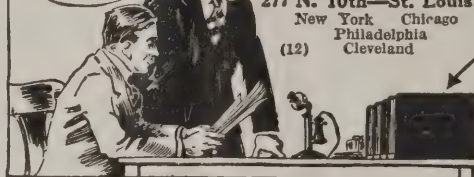
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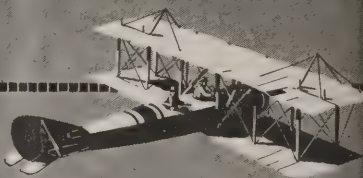
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(Continued from page 147)

to France in commercial air transport, but the English service is limited to regular daily trips between London and Paris. Other journeys are arranged according to demand.

The British commercial air subsidy for 1922 is £200,000, or about \$900,000, half of it to be used for new planes available to operating companies on a hire basis. Dutch, Belgian and German commercial air schedules dovetail into those of French and British companies, making a fairly complete network over the whole continent with the exception of Russia and points in the extreme southeast of Europe.

From London to Paris by rail and boat the fare is \$18.93 and the traveling time 6 hours and 30 minutes. The trip by air costs \$30.66 and the traveling time is 1 hour and 45 minutes. For a trifle more than one and one-half times the railway fare the trip can be made by air at a saving of four hours and forty-five minutes in time.

In other instances air travel is more expensive. The trip from Nimes to Nice, in southern France, costs \$30, which is at the rate of just about three times the mile charge from Paris to London.

Notwithstanding this regulation of air tariffs, according to the exigencies of competition rather than the value of service rendered, air transport in Europe is being developed for the most part on strictly sound principles. Just enough Government encouragement is given to keep the spark of ambition from being smothered under unavoidable financial losses due to the hazards of this new common carrier enterprise.

—Editorial in N. Y. Herald.

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(Continued from page 158)

in air since the model was placed upside down, thus reversing the buoyancy.

APPENDIX

Strength of Crow's Foot

A test was made to determine the strength of a crow's foot such as is used to fasten the ropes on airships and furnished by the Goodyear Rubber Company. The arrangement on the apparatus was as shown in Fig. 2. The small ropes of the crow's foot were fastened to the floor by means of a rope, and the fabric pulled upward by means of a chain hoist. Suspension scales between the crow's foot and the hoist were used to determine the force exerted. The apparatus was tried without the wood frame work about the iron pipe at first, and it was noticed that the middle fingers were taking by far the greater part of the load due to the bending of the pipe. In order that all four fingers might be stressed to more nearly the same degree the wood frame was made so that it supported the pipe at all points, and with a piece about 1 3/4 inches by 2 1/2 inches across the back, as shown in the rear view to prevent the end being bent toward each other. However, even with this arrangement, it was noted that the two middle fingers were under greater stress than the others.

Failure occurred at 1125 pounds which gives, when the weight of the frame is subtracted, practically 1100 pounds. The fiber of the rope held securely, and it was only the fabric at the ends of these fibers which gave way.

Tests to determine the strength of small crow's feet (about 3 inches x 3 1/2 inches) were also made. These were cemented to the fabric of the large crow's foot, and weights applied until failure occurred. Seven tests were made and failure occurred at the following loads:

No. of Test	1	2	3	4	5	6	7
Load (in lbs.).....	190	190	185	185	200	180	18
Average load =	187 pounds.						

The time taken on each test, except No. 7, was about 1 minutes. In No. 7, a load of 160 pounds was put on and left for about 20 minutes, in order to ascertain roughly if time was an important factor. In this test practically all the strands of the cords pulled out, whereas in all the other tests, except No. 6, only part of them pulled out while the others broke, the number which broke varying from 1 to 3.

AERIAL AGE

WEEKLY

V. 15, No. 8

MAY 1, 1922

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Vol. XV, No. 8

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No. 8

Commercial Flying Becoming Safer

RECENT accidents in the air may damage commercial aviation unless the public realizes that most of these are the result of the more dangerous military flying or of the use of obsolete aircraft which should be banished from the air by legislation, Grover C. Loening, president of the Aeronautical Chamber of Commerce, said recently.

Mr. Loening pointed out that commercial machines operated by reliable companies are equipped with a new type of wing section that does not stall in the air. None of the machines in recent crashes were equipped with these.

"While these new types of wing sections are not so applicable to military machines because they reduce the quickness of maneuvering and make a tail spin difficult, nevertheless they are essential on a safe commercial machine because a stall, instead of becoming a dangerous feature, results merely in the plane's settling on a level keel without losing its controlling power," he said.

Mr. Loening pointed out that there are countless rules and regulations for ships and mariners, but as yet practically none for planes and airmen.

"The progress already made in Congress in connection with the Wadsworth bill for a bureau of civil aeronautics in the Department of Commerce shows that there is already a general appreciation of another large group of causes of aviation accidents that can be eliminated. That is the flying on dangerously weakened and old, unfit aircraft, and also by operators of aircraft who are unlicensed or otherwise unsuited to perform the expert and professional duties of an air mariner. Regulation of commercial aviation by law is one of the greatest needs of commercial aviation today. The advantage of such regulation is brought out by the very small number of accidents during the year occurring in Canada, where operators and aircraft are inspected and licensed."

As examples of the safety of commercial aviation properly controlled Mr. Loening pointed to the air mail service, which has been operating daily from coast to coast without an accident in the last forty weeks, and the Aeromarine Airways, which has carried thousands of passengers in safety.

New Use for Planes

AEROPLANES have been used for fighting, bombing, racing, freight carrying, mail carrying, controlling forest fires, gasing caterpillars and other insects, hunting seal herds, locating schools of fish, mapping unknown country, photographing impenetrable swamps and doing hundreds of other jobs, but now they are to be used to track the spread of that most destructive parasite, black stem rust, which destroys one or two hundred thousand bushels of wheat yearly on this continent.

The theory of the Department of Agriculture is that the spores of the black stem rust are carried north to the wheat belt in currents of the upper air. Dr. Stakman of the bureau of plant industry of the Department of Agriculture, in co-operation with officers of the engineering division of the Air Service at McCook Field, is designing spore traps to test this theory. Aeroplanes will carry these traps to great heights, and on opening them at previously determined altitudes will be able to collect the spores carried in the air at various heights and in various wind currents. Once the spore's means of travel and point of origin is determined it can probably be eradicated.

Science and Fire Fighting

THE picture Chief Kenlon recently drew of the Fire Department of the future is all the more interesting because it is so likely to become reality soon. John Kenlon is no visionary, after thirty-five years of the fire fighting game, and when he sees fire engines on the roofs of buildings, helicopters dropping gas bombs on blazes and fire alarms sent by radio it is reasonable to predict that New York will see these improvements, at least in the downtown district, within twenty years.

The war showed, although in a horrible way, the utility and power of gases and chemical liquids. The ingenuity that was employed in destroying life should easily be turned to the more laudable purpose of saving property. If the sprinkler pipes in business buildings should be emptied of water and refilled with some gas which would extinguish fire without damaging floor or goods the saving would be great.

The firemen of the next generation may make his heroic rescues not from a swaying ladder but from a purring aeroplane.—Editorial in *N. Y. Herald*.



THE NEWS OF THE WEEK



National Advisory Committee for Aeronautics Meets

Washington.—A complete and detailed study of the plans and specifications of the Navy's giant Airship ZR-1 was requested of the National Advisory Committee for Aeronautics at its session April 20 by Rear Admiral Wm. A. Moffett, Chief of the Naval Bureau of Aeronautics. Before the rigid airship, whose parts are now being fabricated, but which had not yet been assembled, is completed, Admiral Moffett is desirous of having a thorough study made of all the stresses and strains it is likely to encounter in the air under service conditions and it is for this reason that he has asked the Committee to appoint a special technical subcommittee of aeronautical experts and engineers to make a special study of its design and structure. While the Navy is confident that its own plans for the airship are correct, it is nevertheless desirous of securing the opinion of an independent committee of experts to avoid the possibility of future adverse criticism. The whole committee approved Admiral Moffett's request and authorized its Chairman, Dr. Walcott to appoint a special technical subcommittee for this purpose.

The session of the National Advisory Committee today was the first meeting of the year of this group of twelve government and civilian experts on aeronautics and kindred subjects, operating as an independent government establishment reporting directly to the President, and co-operating with the Government Departments interested in aeronautical development.

Dr. J. S. Ames, Chairman of the Executive Committee, reported on the progress made at the Committee's research laboratory at Langley Field in the development of a new heavy-oil, fuel-injection aircraft engine for the Bureau of Aeronautics, Navy Department. While the details of the development are still held confidential, it is known that its use will greatly reduce the fuel fire hazard in aircraft, which has been largely responsible for the loss of life in recent aircraft accidents. A large percentage of aeroplane fatalities are due to gasoline fire following the crash. This new engine not only does away with the use of gasoline, but also operates without carburetor and spark plugs, thus eliminating certain causes of trouble.

Drawings and performance characteristics of a new high-speed aeroplane wing, just developed at the Committee's laboratory, Dr. Ames stated, have been turned over to the Army Air Service for use in the design of a new high-speed pursuit type aeroplane. This new wing is a thick wing section with space for internally bracing the wing and eliminating any wires or struts in the design of the aeroplane. The wing is both tapered in section and in plan form, conforming somewhat to the general shape of a bird's wing, that is, tapering toward the tip, both of which add materially to the speed characteristics of the wing.

Dr. Ames also explained the operation and application of three new recording instruments recently developed at the Committee's laboratory for studying the performance not only of the aeroplane itself in flight, but the actual conduct of the operator. The instruments are a new type of recording accelerometer, and instrument for recording the positions of the aileron, rudder

and elevator in maneuvering the aeroplane. The use of these instruments, together with a recording air speed indicator, gives a complete history of the loads induced in an aeroplane when maneuvering or landing, together with the range of operation of the aeroplane controls. The information obtained is not only of great value to the designer but also will be very helpful in instructing pilots in the proper use of the controls when carrying out maneuvers.

The meeting was presided over by Dr. Charles D. Walcott, Chairman of the National Advisory Committee for Aeronautics, and Secretary of the Smithsonian Institution. Mr. Paul Henderson, the newly appointed Second Assistant Postmaster General, in charge of the Air Mail Service, was present on invitation. The other members of the Committee present were:

Dr. Joseph S. Ames, Chairman Executive Committee; Dr. S. W. Stratton, Secretary; and Director, Bureau of Standards; Major General Mason M. Patrick, Chief of Army Air Service; Rear Admiral William A. Moffett, Chief of Naval Bureau of Aeronautics; Rear Admiral D. W. Taylor, Chief Constructor, U. S. Navy; Professor Charles F. Marvin, Chief of the Weather Bureau; Dr. John F. Hayford, Northwestern University, Evanston, Ill.; Major Thurman H. Bane, Chief of Engineering Division, Army Air Service, Dayton, Ohio; Dr. Michael I. Pupin, Columbia University, New York City; Mr. Orville Wright, Dayton, Ohio.

Mr. Orville Wright and Mr. G. W. Lewis, Executive Officer of the Committee, leave Washington tonight for Langley Field, Va., where they will make an inspection of the Committee's laboratory and the research work in progress.

Woman Flies 400 Miles to Do Spring Shopping

Chicago.—Mrs. C. E. Tuttle, of Red Oak, Iowa, came to Chicago April 20 by aeroplane to do her spring shopping. She arrived with her shopping list and an overnight bag after piloting her plane over the 400-mile route from Red Oak to this city in four hours and fifty-five minutes. A mechanic accompanied Mrs. Tuttle.

Mrs. Tuttle is the wife of a business man in Red Oak.

New Round-World Flight by British

London.—Plans are well advanced, says the London correspondent of the Yorkshire Post, for another British round-the-world flight but the date of the start has not been fixed.

All preparations have been made by a flying man of much experience and he will pilot the machine. At present he holds a civilian appointment at the Air Ministry and has been given all possible official aid.

A specially designed flying boat of huge dimensions is to be used. The crossing of the Atlantic will be the first stage, starting from Lisbon and taking in the Azores.

The Late Sir Ross Smith

London.—Sir Ross Macpherson Smith, on the eve of his projected flight around the world, was killed in the presence of his brother, Sir Keith Smith, at Brooklands, April 13, while he was testing the

Vickers-Viking machine in which he had planned to make the world circuit. Sergt. J. M. Bennett, M. S. M., the mechanic, who accompanied him on his famous flight to Australia in 1919, was also killed in the crash.

For half an hour before taking up the machine himself, Sir Ross had been in the machine while Capt. Cockerell, of Vickers, Ltd., put her through her paces, during which the Viking behaved beautifully. On descending, Capt. Cockerell handed over the machine to Sir Ross, who, amid shouts of applause from the spectators, made a fine take-off. His brother, Sir Keith, was delayed in reaching Brooklands and so was unable to accompany the intrepid flyer.

For fifteen minutes Sir Ross put the machine through the ordinary flying test. Then he prepared to descend. When about 1,200 feet from the ground he shut off the engine. Almost immediately she began a nose dive, and as the efforts of her pilot to right her failed, she made a spinning nose dive.

Gathering terrific speed as she neared the ground, she smashed to pieces on the fence surrounding the Brooklands automobile race track. Sir Ross was lifeless when lifted from his seat, and Sergt. Bennett, sitting beside him, died a few minutes after being extricated.

No other flight had ever been so carefully thought out. Months ago all the proposed landing fields over most of the 21,000-mile trip had been closely inspected. All the gasoline depots had been planned. It was to have been the crowning achievement of his flying career and Sir Ross had every confidence that he would succeed.

The Viking's gasoline capacity was 385 gallons, giving an estimated range of more than 1,700 miles. It was fitted up with a motion picture camera and sending, receiving and directional wireless apparatus. There were to have been fifty pounds of engine spare parts aboard, and Sir Ross and his companions were to have limited their personal apparel to eight pounds each. Two revolvers, a Winchester rifle and some fishing tackle were to have been carried.

R. K. Pierson was the designer of the Viking. He also designed the machine in which the flight was made to Africa in 1920, the Vickers-Vimy, in which the late Sir John Alcock and Sir Arthur Whitten Brown flew across the Atlantic, and also the machine in which Sir Ross Smith made his 11,294-mile flight to Australia in a little less than twenty-eight days. It was the latter achievement which induced King George to confer knighthood upon the two Smith brothers.

Personal Par

Roger Q. Williams, pilot, plane changer and aerial acrobat, who has been identified with aviation for a number of years, announces that he has given up exhibition work and is using his planes to aid The Jensen Specialty Corporation, of Los Angeles, Cal., in marketing their products. Friends will recall his work with the following circuses: World's Famous Trio, Tinney Fearless Flyers, Sammie Harrell Flying Circus, Sikeston Aerial Corporation, and the Roger Q. Williams Famous Flyers.

The AIRCRAFT TRADE REVIEW

Curtiss Aero Profits

The Curtiss Aeroplane and Motor Corporation for 1921 reports gross profits on sales of \$578,118, and net profits, after all selling expenses and subsidiary company losses, of \$277,466. After allowing for interest charges depreciation, etc., there was a net surplus for the year of \$101,207. The balance sheet at the close of the year showed a profit and loss deficit of \$1,158,924.

C. M. Keyes, President, in remarks to stockholders said that on Dec. 31, 1921, the company had Government contracts on hand amounting to \$1,763,224, "which is sufficient to operate the factory at Garden City and part of the factory at Buffalo. A large percentage of the factory at Buffalo is leased to other manufacturers on a floor space basis."

A. C. C. Joins U. S. C. C.

We are pleased to advise you that the Aeronautical Chamber of Commerce of America has been admitted as a member of the Chamber of Commerce of the United States, the national organization which includes some 1200 or 1500 commercial and civic organizations throughout the United States.

Palm Beach-New York Rapid Flight

Flying at an average speed of 130 miles an hour through three storms, a Loening Air Yacht, carrying a total load of 1,600 pounds, made the flight from Palm Beach, Fla., to New York, a distance of 1,210 miles, in nine hours and fifty-six minutes. Railroad time between the two points is forty-eight hours.

One stop was made, at Southport, N. C. The flyers took off at Southport landing at the Columbia Yacht Club, in the North River, New York City. Clifford L. Webster, former United States Marine Corps aviator, piloted the seaplane, and claimed to have established a time record. Fred R. Golder, of Port Washington, L. I., mechanic, accompanied him.

Webster's machine is the altitude record holder for seaplanes, having taken four passengers a height of 19,500 feet at Fort Washington on August 16, 1921.

Webster said that on several occasions he was compelled to fly as low as twenty feet above the surf to escape dense fogs. Clouds and fog, he said, compelled him to guide his course across Pimlico Sound, North Carolina, and Chesapeake and Delaware bays by compass. The average height at which he flew, the pilot said, was 1,800 feet.

The air yacht in this record flight is of the type recently purchased by Vincent Astor, who has retained Webster as his pilot. Webster was Mrs. Astor's flight instructor at Bay Shore before the war.

Grover Loening, designer and builder of the air yacht, said that he did not regard the flight as indicating that ten-hour trips between Riverside Park and Palm Beach would be common incidents for a year or two yet. But it did indicate, he said, that this particular kind of flying was the safest that could be undertaken.

Learn to Fly

The Dayton-Wright Company, of Dayton, Ohio, have just gotten out a little booklet, "Learn to Fly," which should be in the hands of everyone contemplating a flying course. The Dayton-Wright "Chummy," which is used exclusively in the school, is properly illustrated.

Baltimore to Hold Air Meet

Every year since the close of the war the Baltimore Flying Club has held an aviation meet or, as it is now called, an Exhibition of Aircraft. Each year's meet so far has proven to be a bigger success than the last. In 1919 there were hardly a half dozen ships on the field; in 1920 there were twelve or fourteen and the meet lasted an entire week. This, however, did not prove satisfactory for in 1921 the Club went back to the single day meet and drew the largest crowd they had up to that time, while the exhibiting ships numbered about twenty-five including commercial planes, sport planes, Army planes and National Guard planes.

A departure is to be made this year in having an event for water ships, that is, seaplanes and flying boats. This is easily possible for Logan Field, as the Club's beautiful and well kept airdrome is within a few hundred yards of the Patapsco River, a wide and well protected landing harbor.

The principal event, however, will be for land planes and the contests will be divided into four classes e. g. (1) for commercial planes designated as ships carrying useful load of 750 lbs. or more; (2) for sport planes which includes all one, two and three seaters; (3) for service pilots, Army pilots, Navy pilots and Marine Corps pilots and (4) for National Guard pilots.

For the first time prizes will be awarded but they will not be for speed or high altitude but rather for efficient design and precision flying. This does not mean there will be no speed races, for there will be several, but rather that speed will be secondary to speed range.

It is expected that practically all the entrants at the New York show to be held April 30th will remain over for the Baltimore event and a number of additional commercial entries will be received from the middle west.

The Air Service will send ships from Bolling Field, Langley Field and Aberdeen.

Aerial Lighthouse Established at American Airways Base

American Airways, located at College Point, Long Island, announce the establishment of a highpowered searchlight to be maintained as an aid to aviators. The light will be a 14-inch lens Navy type, and will be thrown at an angle of about 50 degrees elevation, pointing due North. The character of the light, whether a flashing or fixed beam has not yet been decided by the Harbor Commissioners of New York. Announcement of their decision will be made in a later issue.

The light will be visible from sunset to midnight every night, as there are always a number of late flyers coming in down the Sound during the summer months. The base of American Airways is always available for itinerant craft, and mooring and watchman service are available, in addition to regular 'aerial garage' service, such as emergency and permanent repairs, overhauls, etc. The base is equipped to do work of whatever character may be required, being completely equipped.

American Airways have recently been made Curtiss representatives and maintain several machines for demonstration and joy-ride purposes.

Experimental work is going forward on a patent contracting wing, and an all metal amphibian scout.

The Trading School for Aeroplane Mechanics is continually getting new students and those who have been here for some length of time are becoming most proficient in their work. Several ships have been rebuilt this spring, and several others sold. A large number of applicants for the Pilot Training Course recently in in response to advertisements in this publication. The response has been most encouraging.

Spokane News

Spokane, Wash.—Six hundred feet of aerial moving picture films of the Columbia Basin project will be taken by the United States Aircraft corporation.

"Under present plans, our big new six-cylinder Spokane motored ship will leave here and will be equipped with the latest Akeley aviation motion picture equipment," Mr. Messer said. "Upon our return here the films will be turned over to the Columbia Basin committee for use in exploiting the work."

"In addition to the moving pictures, we will take 'stills' at different points along the way. This new ship is especially equipped with a large roomy cockpit for picture making. We have a quick-focus camera mounted on a universal table."

According to present plans the ship will go to the Ephrata district and take pictures over the southern part of the district. Later pictures of the remainder of the entire project may be taken.

A Correction

The following letter is self-explanatory: "Thank you very much for putting me on the cover of your April 10th issue. I am sorry, however, that you called it the SPERRY MESSENGER, as it gives the impression that we are responsible for the design of this remarkable little plane. I wish to correct this wrong impression, as you know that the machine was designed by the Engineering Division of the U. S. Air Service at McCook Field, Dayton, Ohio, which is under the splendid guidance of Col. Bane. Mr. A. G. Ver-ville is responsible for the design, and Col. Guy L. Gearhart fathered the proposition and made a great many valuable suggestions."—Lawrence B. Sperry.

NOTES ON LANDING PLACES FOR SEAPLANES ALONG THE ATLANTIC COAST

Prepared by EWING EASTER

For the National Advisory Committee for Aeronautics

New Jersey

Asbury Park.—Emergency landing for small craft only in Deal Lake. Deal is an artificial lake about a mile long and about 150 yards wide. Several bridges and telephone wires make landing and take-off dangerous. Protected anchorage anywhere. Gas and oil available. No aviation supplies. No beach. No tide. No current.

Keyport.—Excellent landing for all seaplanes. Moorings in deep water furnished by Aeromarine Plane and Motor Corporation, who have large factory there. Repairs and supplies available. High test gas and oil at factory. Three to four foot tide. Beaching facilities.

Delaware

New Castle.—Landing for all seaplanes. No protected anchorage. No beach. Swift current around wharves. Gas and oil available. No aviation supplies. Tide 5 to 7 feet.

Maryland

Annapolis.—Excellent landing for all seaplanes. Good sand bottom and beaching facilities at north end of state road bridge. Annapolis one mile from this point. Weather reports available at Naval Academy. Gas and oil available. No aviation supplies. One foot tide. No current.

Baltimore.—Excellent landing for all seaplanes at Hanover Street Bridge, which can be seen from the air as large concrete bridge south of upper Baltimore harbor. Protected anchorage furnished by Easter Airlines, whose shop and office are located in arch of bridge. High test gas and oil. Aviation supplies and repairs available. One foot tide. Beaching facilities. No current. Ten minutes from business district by trolley. Weather reports available.

Cambridge.—Good landing for all seaplanes. Protected anchorage with firm sand bottom in cove west of steamboat landing. Good beach about one mile west of town. High test gas and oil from Red "C" Oil Company. No aviation supplies. Two foot tide. No current.

Chestertown.—Good landing for all seaplanes. Partially protected anchorage with mud bottom near bridge. Beach on opposite shore from town. Gas and oil available. No aviation supplies. No tide. Moderate current.

Crisfield.—Good landing for all seaplanes. Protected anchorage in creek west of town, with firm sand bottom. No beaching facilities. Gas and oil at public wharf. No aviation supplies. Two to four foot tide. No current.

Easton.—Good landing for all seaplanes. Large craft will land at mouth of Tread Avon River and taxi to steamboat wharf at Easton Point. (One mile from town.) Gas and oil available by truck from town. No aviation supplies. Tide negligible. Moderate current.

Ocean City.—Excellent landing for all seaplanes in Sinepuxent Bay. Good anchorage with sand bottom near bridge. Good beach. Gas and oil available. Two foot tide. Strong current at bridge and wharves. No aviation supplies. Weather reports at Coast Guard Station.

Oxford.—Good landing for all seaplanes. Good anchorage in firm sand. Beaching facilities. Gas and oil available. No supplies. One to two foot tide. No current.

Salisbury.—One-way landing and take-off for small craft only in Wicomico River. Very narrow and twisting. Landings will be made at point in river two miles southwest of town and taxi up to public wharf. No landing for large craft. Anchor in soft mud bottom. Gas and oil available. No supplies. No beach. No tide. No current.

Cape Charles.—Good landing for all seaplanes. Avoid stakes and keep in steamboat channel when taxiing up to wharf. Protected anchorage with sand and shell bottom in cove near steamboat wharf. Gas and oil stations on docks. Three foot tide. No supplies. No beach. No current.

North Carolina

Beaufort.—See Morehead City as landing facilities are much better there.

Columbia.—Good landing for all seaplanes in Bull Bay which is three miles from town. In taxiing up Suppennong River avoid stakes and keep in channel. One-way landing and take-off for small craft in Suppennong River nearer town. Protected anchorage with soft mud bottom. Gas and oil available. No beach. No supplies. No tide. Moderate current.

Bell Haven.—Good landing for all seaplanes. Anchorage for large craft in front of town. Protected anchorage for small craft in creek in back of town. Gas and oil available to wharf by truck. No tide. No current. No beach. No supplies. Avoid submerged reef marked by Wreck East of public wharf.

Edenton.—Good landing for all seaplanes. Protected anchorage with soft mud bottom in creek west of public wharf. Gas and oil available. No beach. Two to three foot wind tide. Moderate current. No supplies.

Elizabeth City.—Good landing for all seaplanes. Protected anchorage in harbor, with mud bottom. Gas and oil available at public wharf. No aviation supplies. No tide. No current. No beach.

Hertford.—Good landing for all seaplanes. Avoid stakes in landing and taxiing. Protected anchorage with firm sand bottom. Gas and oil available by truck. No supplies. No tide. No current. Good beach.

New Bern.—Good landing for all seaplanes. Unprotected anchorage with firm sand and mud bottom. Severe northeast gales frequent between November and April. Gas and oil available at public dock. No supplies. No tide except wind tide. Moderate current. No beach.

Oriental.—Good landing for all seaplanes. Protected anchorage, with firm sand bottom. Gas and oil available from garage in town. One to three foot tide. No current. Good beach.

Plymouth.—One-way landing and take-off for small craft only. Not safe for large craft. Dangerous as river is narrow and bordered with high trees. (Width of river about 200 feet.) Protected anchorage with soft mud bottom. Gas and oil available. No supplies. No tide. Moderate current. No beach.

Morehead City.—Excellent landing for all seaplanes. Unprotected anchorage in front of city. Gas and oil available at gasoline docks. Weather reports and aviation supplies available from Coast Guard Air Station two miles south of town. Also beaching facilities there. Four to five foot tide. Swift tidal current at wharves.

Southport.—Excellent landing for all seaplanes. Unprotected anchorage, rocky bottom. Gas and oil at wharf. Two foot tide. Beach. No supplies.

Swann Quarter.—Good landing for all seaplanes in Juniper Bay. Seaplanes will beach at entrance of canal one-half mile from town. Protected anchorage with firm sand bottom. Gas and oil supplies not always available. One to two foot tide. No aviation supplies. Good beach. No current.

Washington.—Landings for large craft will be made east of railroad bridge about one mile from city. Landings for small craft can be made in front of city between bridges. In landing here avoid small stakes. Gas and oil for large craft by truck from city, for small craft at gasoline docks. Good anchorage, mud bottom. No tide. No beach. No supplies.

Wrightsville Beach.—Landing for all seaplanes in sound north of bridge. Take-off along sound to north or through inlet to ocean. Numerous sand bars to be avoided. Unprotected anchorage in sound with sand bottom. No gas and oil except by trolley from Wilmington during winter months. Gas and oil available in summer. Trolley service to Wilmington all year. Two to four foot tide. Swift tidal current. Good beach. No aviation supplies. This is the best point of landing for Wilmington as the river at that point is narrow with submerged stumps and exceedingly swift current.

Wilmington.—See above.

South Carolina

Beaufort.—Landing for all seaplanes. At high tide avoid submerged reef and marshland extending about one-quarter mile out from point of land on opposite shore east of town. Moorings available in front of K. of C. wharf. Good anchorage here also with firm sand bottom. Gas and oil station on steamboat wharf. Aviation supplies available and beaching facilities at Marine Air Station, Paris Island. Four to six foot tide. Strong tidal current at wharves.

Charleston is marked on your map so I presume you have full data. Paris Island is also marked on your map.

Georgetown.—Good landing for all seaplanes in Winyah Bay and taxi quarter-mile up creek to town. Anchorage at mouth of creek with firm sand bottom. (Do not anchor in creek in front of town as bottom here is smooth rock.) Gas and oil

available at wharves. No supplies. Two foot tide. Swift tidal current at wharves. Beach at mouth of creek.

Georgia

Savannah.—One-way landing and take-off for all seaplanes. Unprotected anchorage with mud bottom. Gas and oil available. No aviation supplies. Swift current. No beach. — foot tide.

Fairhope unsuitable for landing.

Darien unsuitable for safe landing.

Brunswick.—Landing for all seaplanes. Protected anchorage in front of abandoned Naval Air Station. Gas and oil available at public wharves. Tide three to four feet. Strong tidal current at wharves. Beach at Air Station. No supplies.

Fernandina.—Good landing for all seaplanes. Unprotected anchorage near mud flats opposite city. Protected anchorage in creek south of city. Severe northeast gales frequent from November to May. Gas and oil at gasoline docks. No supplies. Six to eight foot tide. Swift tidal current at docks. No beach.

Deland.—Landing for small craft only in Lake Breesford which is three miles from town. Protected anchorage anywhere with mud bottom. Gas and oil available at dock. No supplies. No tide. No current. No beach.

Note.—The St. Johns River route is unsafe for any but very small craft south of Lake George, as the river is narrow and very twisting.

Green Cove Springs.—Good landing for all seaplanes. Protected anchorage on either side of steamboat landing. Gas

and oil available from garage by truck to wharf. One to two foot tide. No current. No supplies.

Palatka.—Landing and take-off for large craft north of railroad bridge or south of state road bridge. Landing for small craft between bridges for take-off in small bridge taxi through railroad drawbridge and take-off on north of same. Gas and oil available for large seaplanes by truck and for small craft at public wharf. No supplies. No beach. No tide. No current.

St. Augustine.—Excellent landing for all seaplanes north of bridge. Anchorage with mud bottom anywhere in front of town. Protected anchorage and beach in creek at north end of town. Gas and oil available at Capo's wharf or from garages. No aviation supplies. Three foot tide. Strong tidal current at wharves. Weather reports from Coast Guard Station.

Sanford.—At head of St. John's River route for small craft. Excellent landing. Protected anchorage with firm sand bottom near public wharf. Gas and oil available from garages. No beach. No tide. No current. No supplies.

Note.—I have operated an "F" boat at the points mentioned and this above report is based upon notations made at the time.

Latitude and longitude is not given as I have no means of ascertaining this data at hand.

In giving the rise of tide I have not taken the figures for mean neap tide but have given figures which allow for the maximum rise due to wind conditions, which are of more interest to the seaplane pilot.

SOME PRINCIPLES GOVERNING THE ESTABLISHMENT OF METEOROLOGICAL STATIONS ALONG AIR ROUTES*

• By P. AUJAMES

Chief of the Radio Meteorological Service of the Compagnie Franco-Roumaine de Navigation Aérienne

The organization of a meteorological service for an air route involves the solution of two distinct problems:

1. Distribution and grouping of meteorological stations;
2. Communications.

Experience gained in the establishment of two lines, Paris-Warsaw and Constantinople-Bucharest** enables us to establish certain principles, which it may be of interest to note here.

I. Distribution and Grouping of Meteorological Stations

Before touching upon the study of this question, it is well to recall the principles for laying out an air route. When it is proposed, under existing conditions, to establish a regular airplane transportation service between two points 1,500 or 2,000 kilometers apart, it is out of the question, for technical and commercial reasons to fly the whole distance without landing.

Therefore the line is divided into sections of 400 to 500 kilometers, terminating in large cities. Aeroplanes traverse these sections in a single flight. Example: Paris-Strassburg-Prague-Warsaw.

Laying Out the Sections.—A section of an airway should not be regarded as a straight line between two cities (which would be a serious mistake), but as a passage-way from 0 to 100 kilometers wide, within which the actual track is determined by experience, that is to say, from a perfect knowledge of conditions in the regions traversed, thus assuring maximum safety by encircling obstacles, flying over the reatest possible number of landing fields, avoiding districts in meteorological disturbances, etc.

In aviation, a straight line is not the shortest distance between two points, for example: Constantinople-Bucharest by Adrianople and Giurgevo. On this route the itinerary followed by the aeroplane changes from day to day and from one part of the day to another.

The duty of the meteorological organization consists in supplying at any moment information enabling:

1. The departure of aeroplanes, when the atmospheric conditions are suitable for flying and landing with safety;
2. The determination of the path to be followed within the strip of territory constituting the section.

Meteorological Organization.—Granting the above, the meteorological organization of a section comprises:

(a) The division of a section into a certain number of zones. These zones are portions of the territory with uniform climatic conditions. Examples: Champagne, Lorraine, the Barian plateau, Thuringia.

This division necessitates a very careful meteorological study. In each of these zones a variable number of meteorological stations will be installed.

(b) Types of zone meteorological stations, three types:

1. Central stations for collecting information and making soundings, and mountain stations;
2. Auxiliary observation stations.
 - (a) Along the route.
 - (b) For near lateral protection.
3. Stations for distant lateral protection.

Central Stations

These must coincide as much as possible with regular or emergency landing fields. In each section it is necessary to have at least as many stations of this kind (not including mountain stations) as the average number of hours of flight required for traversing the given section. A station of this type is also established on some summit in every mountainous region traversed. Such stations are provided with complete meteorological outfits. Their personnel comprises at least one meteorologist and one assistant. They can, in particular, make soundings with pilot balloons (or captive balloons). It is assumed that the wind direction and velocity are constant throughout the entire zone within which a station is located, as determined by the soundings.

These stations are connected with the auxiliary observation stations by some suitable means of communication.

Auxiliary Observation Stations

These stations should be located, some in quincunx formation relative to the median line of a section and at 40 kilometers from this line, the others (few in number) on the line itself.

It is a common error to wish to increase the number of observation stations on the direct line between two points on the map. This is a result of the error committed in defining the path of an air route and always results in limited information.

These auxiliary stations do not make soundings. Their only duty is to observe cloudiness and visibility. They do not require special apparatus or personnel. It is sufficient to have agents residing in the locality, such as teachers, customs officers, etc.

The aerial navigation companies have decided to maintain a complete system of these stations. Their distribution in quincunx alone enables the utilization of the meteorological information, even two or three hours after the observation. The fundamental difficulty encountered is that of communication. In the usual case of a wind blowing across the section, the lateral stations enable a fairly exact forecast of cloudiness and variations of visibility in the strip of land included in the

* From "Premier Congrès International de la Navigation Aérienne," vol. I, pp. 115-119, Paris, November, 1921.

** French Aeronautic Mission in the Orient.

section, and, consequently, the determination of the itineraries of the aeroplanes.

Stations for Distant Lateral Protection

In order to be able to make forecasts for periods of five or six hours and to protect the line against violent storms, it is necessary to locate meteorological observation stations at distances of from 110 to 150 kilometers from the line. These stations are selected from among those included in the meteorological organization of a country. Example: Line, Paris-Strassburg: Dijon-Mabeuge; Strassburg-Prague: Frankfort-Munich.

II. Communications

Since it is important to choose well the location of the stations, to group them in a proper manner and to make careful and frequent observations, it follows that the most difficult problem to solve in the organization of the air routes is the problem of communication. The value of the meteorological service depends on the efficiency of its lines of communication.

It is much less difficult to make observations, than to assemble and make prompt use of them. A meteorological report however, is really valuable only at the time of the observation.

It is necessary, therefore, to establish a very complete and perfect system of communications. This can only be brought about gradually. It is by constant effort, great patience and much expense that valuable results can be obtained.

The communication problem consists of two parts:

- (a) Assembling the information;
- (b) Interpretation and use.

Assembling the Information

Central stations and mountain stations must be equipped with telephonic and radiotelegraphic systems of communication.

(a) Radiotelegraphy can alone assure sufficiently prompt transmission of information to the other central stations of the line. It alone enables the reception of information from these stations and from the stations for distant lateral protection.

Experience shows that aerial navigation cannot do without a specialized radiotelegraph system, which alone can assure a sufficiently rapid communication for the needs of air traffic and the meteorological service. Such a system is being created in France and in England.

The utilization of non-specialized telegraphic and radiotelegraphic systems in other countries is the source of great difficulties. Communications are intermittent and messages travel too slowly. Moreover, this expedient does not enable communication with aeroplanes.

(b) The principal and secondary stations are connected by telephone (except in special cases). It is necessary to obtain telephonic priority, which is very troublesome. The communications must be sent at a certain time for regular observations, aside from which they are only sent as exceptional messages, in case of storm warnings. It is important for these warnings to be transmitted as promptly as possible.

Interpretation and Use

Assuming that the information is brought together in the desired time, it is important to profit from it as much as possible. First it must be interpreted and then put to the best use. It is necessary for the contact between meteorologist and pilot to be close and constant. It must be recognized that the pilots are very skeptical concerning the accuracy of meteorological information. At the opening of a line, much patience is therefore required to win them over and obtain their confidence.

The meteorological information must be presented in as concise and simple a form as possible, easy to assimilate and to use. At each airdrome, the meteorological information received must be posted from hour to hour. The best means consists in having very legible conventional signs on a map, as is done at Le Bourget and in general at all the airdromes of the S. N. A. (Service de la Navigation Aérienne) in France. But this precaution does not suffice for utilizing the information as a whole. It is dangerous to rely on the memory of the pilots and errors of interpretation are to be feared.

It is necessary to place before the eyes of the pilot, on the aeroplane itself, a card showing graphically all the information in condensed form and indicating, by way of suggestion, the proper itinerary for him to follow and the altitude at which he should fly. It is also advisable to obtain from pilots their detailed criticism of the information furnished.

With the "Compagnie Franco-Roumaine" I use a graphic system which gives good results. Since the adoption of this system the pilots have gradually acquired greater confidence in the value of the reports, and furthermore, it is possible to keep strict watch over the work of the meteorological stations.

Communication from Ground to Aeroplane

In all of the above, we have supposed that the aeroplanes did not have radiotelegraph and radiophone apparatus enabling communications with the ground.

With the approaching use of very large aeroplanes, necessarily involving radio-electric installations, the meteorological communications will also be facilitated. There will also be an exchange of information between the ground and the aeroplane.

In general, an aviator should receive information from the ground regarding a region an hour before flying over said region (sounding by the central station). This information determines his average altitude of flight. He should also receive the reports from the auxiliary observation stations giving the visibility and the cloudiness, thus enabling the determination of his itinerary.

This precaution is fundamentally important for the landing zone at the terminal. In fact, it must be ascertained whether the visibility is sufficient. The duty of the navigator aboard the aeroplane is to interpret this information and inform the pilots as to the proper route. Furthermore, instruments like the "navigraph" of Mr. Le Prieur, enable accurate checking up of the route followed. It also enables at any instant the determination of the air speed. We can therefore conceive of the possibility of accurate observations aboard such an aeroplane, which would constitute a veritable flying observatory. There will then be a means of checking ground observations on the aeroplane from which other aeroplanes flying over the course can profit greatly. This advantage, especially in foreign countries, will partially offset the lack of satisfactory ground meteorological service. The times for making the soundings must be determined by definite instructions. They must precede, at each point, the regular passage of the aeroplane by an hour. On the other hand, ground stations must always be ready to reply to questions from an aeroplane. The aviators must listen frequently for short periods, in order to allow the ground stations to send them particularly urgent information, especially storm warnings.

Such are the principles, learned by experience, which must guide us in the organization of a meteorological service.

(Translated by the National Advisory Committee for Aeronautics)

Texas College Students to Receive Flying Training

The Air Service Unit at the Agricultural and Mechanical College of Texas is the youngest of five units in that State, having been organized in December a year ago. The unit started this year with 102 men, but the 609 examination (physical examination for fliers) disqualified about forty of these men. The students are a highly enthusiastic bunch, all intensely interested in the course, and many of them will eventually become reserve pilots.

During the first two years at this college, students cover elementary military subjects. During the last two years they cover in the main purely Air Service subjects, including aeroplane engines, aeroplane instru-

ments, bombing, aerial gunnery, aerial photography, radio, machine guns, artillery observation and Infantry and Cavalry liaison.

At the end of the Junior year, the students attend a six weeks' camp at some Air Service field, where they are given a great deal of back seat work as observer and also given an opportunity to take short courses in engines, aeroplanes and all other work connected with an Air Service station. Upon graduation these men are given commissions as reserve second lieutenants and ordered to active duty for a period of six months in order to permit them to obtain their flying training.

The camp this summer will be held at Kelly Field, and the Junior Class is hard at work preparing themselves for the work

they will do at the camp this summer. Due to the hardships of the 609 examination, there will be only seventeen men qualified for the camp.

The Cadet Major of the Squadron, James E. Gardner, is a former Air Service officer, who left school during the war and enlisted for the Air Service. He completed his ground work course at the University of Texas, his primary training at Call Field, and his advanced training at Ellington Field. After the Armistice, Mr. Gardner returned to college, and will graduate this year in architectural engineering. He is considered one of the very best cadet officers at this institution, and it is in a great measure due to his earnest work for the squadron that such an esprit de corps in this unit has been built up so soon.

COMMUNICATIONS AND BEACONS ON AIR ROUTES

By CAPTAIN FRANCK

Service Technique de l'Aéronautique*

Need of Communications and Beacons

The aircraft which undertakes a journey requires information as much before its departure as during the flight. During travel it is necessary to find a route marked by some suitable system of beacons.

Communications.—The information required before departure is chiefly meteorological in nature. For the navigator starts only in case the weather announced to him along the route is such that he can safely undertake the journey with the aircraft and the navigation instruments at hand. Meteorological information consists in the knowledge of the existing weather conditions at different points along the line and in forecast of the probable weather along the route during the trip. Now the weather can be known and the forecasts made and distributed only when a system of very rapid communication is satisfactorily organized.

When he has decided to start, the air navigator should notify the point of destination and the principal landing fields along the route. The latter would then be able to have the beacons readied, in case they are not constantly in operation, and to assist the aviator by all possible means during the trip. During the flight, incidents may occur (such as changes in the weather and difficulty in finding the way) which will make it necessary for the aviator to communicate with the ground. The ground organizations whose duty it is to look out for his safety may give information to send him (sudden and unforeseen changes in the beacon storm warnings, etc.). Finally, on arriving at the destination, he must notify the aerodrome from whence he departed, as well as the intermediate landing fields, so that at any moment they will be posted as to the position of the different aircraft.

The system of communications of air routes must therefore comprise communications on the ground and between the ground and the aircraft in flight. These communications must be reliable and practically instantaneous. On this account it is necessary to employ means designed for this special purpose, to the exclusion of those used for other purposes. The latter means may however be utilized in case of failure of the former and such use should be anticipated and provided for in advance. It is no less true however that the airways need their own system of communications.

Marking.—Aerial navigation can use the methods of sea navigation and also similar instruments, compass and sextant, for example. But while the sea is practically motionless or influenced by regular currents, the air is disturbed by currents which vary almost constantly in speed and direction and which change with altitude. The result is that, when the aerial navigator no longer has a landmark to observe, it is impossible for him to take account of the possible changes in his drift and to follow precisely the desired route. It is therefore necessary to place more beacons along the routes he must follow. Lastly, it is necessary to give him numerous means for determining his position or for following a well-defined route without losing it, no matter what the weather may be.

Thus the marking of air routes requires day signals, night signals and electro-magnetic or other signals capable of replacing the visual signals in foggy weather.

Means Employed to Establish Communications and Beacons

Communications.—The only means of rapid communication suitable for aviation are radiotelegraphy and radiotelephony. In fact, these are the only possible means of communication between the ground and aircraft. On the ground, ordinary telegraphy or telephony could be employed, but their use would require the installation of special direct lines at a prohibitive cost. This method of communication would be of use only if multiple telegraphy and telephony made possible by the use of high frequency on ordinary lines, should become common and thus increase the efficiency of electrical circuits to the point of considerably diminishing the cost of a direct communication by wire. This point has not yet been reached. In France, the system of communication adopted on air routes is the following:

Land Communications.—These are maintained by the aid of continuous radio sets, with a range of 800 kilometers. These sets may be employed either for telegraphy or telephony, as desired. In practice, land communications are made by telegraphy, thus obtaining greater efficiency.

Com Rappports du Premier Congrès International de la Navigation Aérienne, Vol. 1, pp. 110-114.

2. Communications from the Ground to Aircraft.—On the ground sets like those described above are employed. Messages transmitted by them can be received aboard aircraft up to 500 kilometers by telegraphy and by telephony.

On aircraft, the companies use the apparatus found in commerce. The range required depends on the distance between ground stations with which it is possible to communicate. The routes now in operation can work under favorable conditions with sets having a range of 300 kilometers.

Telephony is very practical for communicating between the ground and aeroplanes. In fact, it does not necessitate acquaintance with the Morse alphabet. After a little training, any member of the crew can use, so that it is not necessary to have a radiotelegraph operator on board. On international lines, however, it is difficult for operators speaking different languages to understand each other by telephone.

3. Organization of Communications.—All the important landing fields and all of those where a meteorological station is installed are equipped with a station for land communication.

All terminal fields and all those where meteorological information is gathered are equipped with radio stations for communicating with aeroplanes.

On a given landing field which needs to communicate both with other fields and aircraft, these communications may be made either by means of a single station or two different stations, according to the volume of traffic.

b) Beacons.—**1. Day Beacons.**—These include route landmarks and markers on the landing fields.

To indicate the routes, the names of the landing fields along the way are marked with large letters. If this is insufficient the names of important places are marked either on the roofs or on the ground. Consideration has also been given to the question of beacons for air navigators in bad weather. For this purpose, captive balloons have been sent up above the layer of clouds during foggy or cloudy weather, but up to the present time this method has not given satisfactory results.

Landing fields are marked in the following manner. The center of each field is indicated by a circle with a diameter of 50 meters in which the name of the field is inscribed.

In certain cases, four lines radiating from the perimeter of the circle indicate the four cardinal points.

The boundaries of the landing field, wherever they are not evident, are marked by spaced lines on the ground, or by disks mounted on low supports. Special markers are placed at the corners of the landing field in order to outline its contour in snowy weather. All of the obstacles which may exist are indicated by red and white pennants.

The direction of the wind is given by a movable landing-T which automatically orients itself. A flag mounted on an elevated support indicates the direction which must be followed around the field.

2. Night Beacons.—The marking of routes is accomplished by the aid of special lights. The form of the beam is such that they are visible at an altitude of 2,000 meters and at a distance of 40 kilometers with medium visibility. These lights are located in the vicinity of landing fields which mark the route, to indicate their situation. If the number thus installed is insufficient, others are placed between the fields. They emit series of long and short flashes, in different and characteristic combinations.

The installation of very powerful lights at certain important points on air routes has been considered. Two are now being built by way of experiment. It is expected that they will be visible at a distance of 150 kilometers with a transparency of 9.925.

Landing fields are marked in the following manner: Their situation is determined as already mentioned for the marking of routes. Obstacles are indicated by different lights. The direction of rotation is given by a luminous circle; the direction of the wind by a series of lights on the same T used during the day.

The greatest difficulty at night consists in marking the place and direction for aircraft to land. The International Aerial Navigation Convention recommends a method which consists in dividing the landing field by means of lights into three sections: a landing section, a neutral section and a section for departure. But the direction of these sections must be changed whenever the wind changes. It would be necessary, in order to accomplish this, to have quite a large night personnel, or to adopt a system of subterranean electric lights placed under

(Concluded on page 190)

NOTES ON PROPELLER DESIGN

The Energy Losses of the Propeller—I

By MAX M. MUNK

(Technical Note National Advisory Committee for Aeronautics)

THE knowledge of the different kinds of energy losses of the propeller and of the magnitude of the losses in each single case is of great value to the designer. There are three different kinds of energy losses, and the most important has been the least often discussed in the publications of recent years. This is the friction between the air and the blade when whirled through it. Suppose the propeller to be well shaped, so that each blade element is working under a proper angle of attack. Corresponding to the induced drag of an ordinary wing, there are then coming into action the slip stream loss and other similar losses to be discussed afterwards. Besides, there is the friction of the blade surface moved through the air.

The drag coefficient which expresses the relative magnitude of this friction depends, it is true, on the blade section and on its angle of attack or, what amounts to the same thing, on its momentary lift coefficient. But the variability of the drag coefficient for reasonable angles of attack is much smaller than often supposed, the variation for different sections as well as for different angles of attack being small. There is a certain minimum of the drag coefficient existing, which it seems can always be obtained under reasonable conditions by the proper choice of the section, whether the desired lift coefficient be smaller or greater. Hence it is admissible to assume the drag coefficient C_D to be constant for all propellers under those particular conditions for which it is chiefly designed.

The energy loss produced by the drag is the sum of all these losses of each single blade element. Let i be the number of blades, b their breadth at the point considered, v the velocity of the blade element relative to the air, r the distance from axis, dr the length of the blade element, and D the propeller diameter. The entire loss per unit time due to friction is then

$$\int_0^D \frac{1}{2} \rho v^3 \frac{C_D}{V_0} b \, dr$$

Excepting the velocity v all quantities occurring in this expression are only moderately variable and may be replaced by their mean values for the present purpose. This velocity determines the dynamical pressure $\frac{1}{2} \rho v^2$, and this pressure is the sum of the dynamical pressure of the tangential velocity and of the velocity parallel to the direction of flight, for these two velocities are at right angles to each other and hence the sum of the squares equals the square of the resultant velocity. But the square of the velocity in the direction of flight is so much smaller than the square of the tangential velocity over the greatest part of the propeller blade that it is admissible to neglect it for the following estimation of the magnitude of the drag coefficient and to make a correction for it afterwards. Substitute, therefore, $v = 2\pi r n$ where n denotes the number of revolutions per second. The loss produced by the drag remains then

$$8 \rho \frac{C_D}{2} b \pi^2 n^3 \int_0^D r^3 \, dr$$

This integral has the value:

$$(1) \quad \frac{1}{8} i C_D \frac{\rho}{2} b n^3 D^4 \pi^2$$

The thrust calculated in the same way appears

$$(2) \quad \frac{1}{6} i C_L \frac{\rho}{2} b n^2 D^3 \pi^2$$

The lift coefficient C_L can assume very different values as it is not restricted by a lower limit as the drag coefficient is, and its upper limit is rather high. For several reasons, however, the lift coefficient actually used with propellers intended for similar conditions always keeps within narrow limits. A lift coefficient which is too small requires too large a blade area and hence too clumsy a propeller, also C_D/C_L is thus small as a consequence. A very high lift coefficient it not compatible with a small drag coefficient nor with a small ratio of the drag coefficient to the lift coefficient. There is finally the consideration of fairly good efficiency over a wider range of constant revolutions for different conditions of flight. For all these reasons the lift coefficient of propeller blades is far less variable than would appear at first glance, and this holds even more for the ratio

$$\frac{\text{lift coefficient}}{\text{drag coefficient}}$$

This ratio has a maximum which occurs for moderately high lift coefficients, but the actual lift coefficient will not be very different from the most favorable one, and hence the ratio C_L/C_D can be assumed constant for a rough estimation.

This leads to a convenient approximate formula for the propeller loss due to friction. For the useful work per unit of time is $T V$, and hence the ratio of the loss of friction, A , given in equation (1) to the useful work $T V$ where the thrust T is given in equation (2) can be written

$$(3) \quad A \frac{D n \pi}{V}$$

where A is a constant or at least is nearly constant for all good propellers under their best conditions of performance.

The approximation is valid only as long as the ratio of the tip velocity $n D \pi$ to the velocity of flight is great and the efficiency is fairly high. If then the number of revolutions is prescribed, the consideration of the friction alone demands a small diameter. In intend to discuss the question of the best diameter more fully in a later note, but it may be mentioned here that for an usually small diameter the loss of friction ceases to be the dominant part of the entire loss and the second kind of losses becomes important, calling for a great diameter.

The losses of the second kind are the equivalents of kinetic energy transferred to the air in the form of regularly distributed motion. The chief part is the slip stream loss. It has been discussed so often during the past fifty years that it seems admissible to state the result without repetition of the proof. The ratio of the lost energy to the useful work performed by the propeller is *

$$\frac{1}{2} (V_1 + C_P - 1)$$

where

$$C_P = \frac{T}{V^2 \frac{\rho}{2} D^2 \frac{\pi}{4}}$$

*N. A. C. A. Report No. 114 and Technische Berichte II, p. 78.

This becomes $1/4 C_P$ for very small values of C_P but the approximation is not good for greater values of C_P where it gives values that are too great. This expression for the loss is the minimum, occurring for uniform distribution of the thrust over the propeller disc. This condition is not compatible with a finite number of blades, for a blade like any other wing is unable to produce a finite density of lift at its utmost end. Hence the finite number of blades involves a small increase of the induced loss.

A third kind of induced losses is a consequence of the rotation around its axis which the slip stream assumes. This kinetic energy however is not entirely lost if the propeller is in front of the fuselage and of the wings. The wings produce a kind of honeycomb effect and straighten out part of the rotation. Besides, the decrease of pressure in front of the fuselage and the radiator diminishes the drag of the aeroplane.

The additional induced losses can be taken into consideration by introducing an effective diameter D' smaller than the real diameter and using it for the calculation of the energy losses. If, for rough calculation, the approximate formula for the loss, $1/4 C_P$, is taken, the result is too great, as said above, and it may be assumed that the additional losses are already contained in it.

The entire efficiency appears now

$$\eta = \frac{1}{1 + A D n \pi / V + \frac{1}{2} (\sqrt{1 + C_P} - 1)}$$

or approximately

$1 - \eta$ is about $A D n \pi / V + B C_P$
where A and B are constants which do not vary greatly for

different propellers under their most favorable conditions. A is expected to be about $3/4 C_D/C_L$ B to be in the neighborhood of $1/4$ for great velocities of flight.

Another kind of loss is not considerable. This is the loss through the interference of the propeller and the aeroplane. This loss is not even necessarily positive. The interference in general creates a force between both propeller and aeroplane, increasing thrust and drag. This alone involves no loss. Furthermore, there is the increase of the drag of the fuselage by the slip stream. This is often added to the original drag of the aeroplane for matter of convenience, and not considered as a direct loss of the propeller, although it is to be attributed to its existence. The remaining loss of interference is small in general and can probably be neglected.

I have discussed the different kinds of energy losses of the propeller with the intention of determining the most probable value of the respective constants. The data available for this purpose are extremely scarce and unexact, but it seems pertinent and necessary to determine the most probable values and to use them until they can be replaced by some exact ones. The best method for obtaining these at present is the investigation of a stationary propeller of the same dimension and speed as an ordinary propeller, but especially designed for the test. These conditions were fulfilled to a certain extent in the tests of Dr. Schmid. * The scale of his propellers was large enough, but the speed was somewhat low. Besides, the sections investigated were comparatively poor, which is not surprising, for the tests were made as early as 1912. With one propeller, the distribution of velocity in front and behind the propeller was determined too.

This test showed that the slip stream loss was exactly 100% of the expected value. The loss due to rotation was confirmed to agree with theory to within 10% error, but here the exactness of the test was far less. This test then justifies the application of the theoretical coefficients for the determination of the induced losses, (leaving the determination of the friction losses only to empirical investigation).

The same test of Dr. Schmid gives a lift coefficient $C_L = 0.50$ and a drag coefficient $C_D = 0.023$ calculated by means of the formulas 1 and 2. Thus C_L/C_D appears to be 22. This is in good agreement with the values known from the ordinary wind tunnel tests with wing models, if the induced drag is taken into proper consideration.

The second source of information is free flight tests which lead to the determination of the efficiency of the propeller. These tests consist in gliding tests with stopped engine, thus giving the drag of the aeroplane. This being known, flights with running engine give the propeller efficiency. With airships, the gliding is replaced by negative accelerated runs with stopped engine. The greatest error of the test comes in owing

*Bendemann: Luftschrauben-Untersuchungen, Muenchen, 1918.

to the drag of the stopped propeller, which has to be subtracted from the drag obtained from gliding. I have previously published results of both kinds of free flight tests and refer to them, as I am better acquainted with them than with similar tests made by others. The tests with the Brandenburg seaplane gave a maximum efficiency of 71%, so did the tests with the Zeppelin airships. It has to be mentioned that both aircraft had a comparatively low speed and hence their slip stream loss was high. The method of calculation described in the first part of this note gave:

	C_L	C_D
Test of Dr. Schmid.....	.50	.023
Brandenburg Seaplane.....	.54	.024
Zeppelin Airships.....	.54	.025

From these data I conclude that the probable value of the minimum C_D for propeller blades is .024. As explained before, this coefficient refers to too small a dynamical pressure, the dynamical pressure of flight being neglected, and it should be applied when using the formulas 1 and 2 only. Now the mean tangential velocity is about

$$0.7 \pi D n = 0.7 \quad 10 \times 25 \pi = 550 \text{ ft/sec.}$$

The velocity of flight is about 140 ft/sec, and the square of this velocity of flight is about $6\frac{1}{2}\%$ of the square of the mean tangential velocity. The value for C_D appears from this to be $6\frac{1}{2}\%$ too large. The most probable value of the drag coefficient is then finally

$$C_D = 0.020.$$

The presentation of this important value and of the reasons which lead me to its adoption is the main subject of this note. The value of C_L/C_D would appear to be 22. This value is not changed by the correction of the dynamic speed.

The constants are then expected to be $A = 0.034$ and $B = 0.25$. The maximum efficiency of any propeller is then about

$$1 - 0.034 \frac{D n \pi}{V} - 0.25 \frac{T}{V^3 \frac{\rho}{2} D^2 \frac{\pi}{4}}$$

For an average value of $C_L = 0.50$ this would give

$$1 - .034 \frac{D n \pi}{V} - .083 \left(\frac{ib}{D \pi} \left(\frac{D n \pi}{V} \right)^2 \right)$$

An experimental method which also gives information on the air forces of propellers are tests with small propeller models, mostly at low speeds of revolution. These tests of course can not be used for the determination of the drag coefficient, as this coefficient depends on the Reynolds number. It has been found however that most of these tests give about the same result, so that if others give greatly different values, these tests must be considered as doubtful.

AVIATION IN MONTANA

Taking pride in the past advancement made in the face of unusual obstacles, Montana aviators are looking for this year to produce the greatest aerial activity yet known in this region. A number of new ships have come into the State, and various towns are preparing for the laying out of landing fields. In the past two seasons interest in flying has developed rapidly among the public, and the increase in civilian flying is expected to be rapid and large from this year on.

Although there was some flying in the State preceding the World War, the history of Montana aviation as a commercial proposition does not begin until the spring of 1919, when former Lieut. John Farrell organized the Montana Curtiss Aeroplane Co. at Bridger, Mont. The company operated two Curtiss JN4-D's successfully during the summer of 1919, but disorganized in the fall. The pilots were Farrell and W. G. Setzler.

The Inland Empire Aerial Training Corporation of Butte, was incorporated in the summer of 1919 and operated one Curtiss JN4-D. Former Lieut. L. G. Rees was the pilot. For a year the corporation was highly successful, adding two machines to its fleet, a Curtiss Oriole and another JN4-D. These machines were flown by former Lieut's R. N. Wilford and William Iverson.

Pilot L. G. Rees holds three records for

flying in Montana. He crossed the continental divide with passengers in a Curtiss JN4-D five times without accident, flying at an altitude of 9,000 ft. He carried the youngest passenger ever taken aloft in Montana, Evelyn Schmidt of Whitehall, age ten weeks. This may be a world's record. Pilot Rees made the first regular delivery of newspapers by aeroplane in the northwest, carrying editions of the Billings Gazette of Billings, to Roundup and Winnett. In the summer of 1920 this company met a serious setback the Oriole being destroyed by fire.

Thereafter L. W. Lamb with Pilot Rees formed the Montana Standard Aeroplane Co. of Billings and operated successfully during the 1921 season. The company is now mapping out a large program for 1922. This company last year used Lincoln Standard Aeroplanes.

The Aero-Miles City Club of Miles City was organized in the winter of 1920-21. The Club flew two Curtiss Standards and accomplished much good work last summer. E. T. Vance and A. W. Stevenson were the pilots.

So far the various Montana aviation companies have derived their revenue from passenger carrying, exhibitions and different forms of aerial advertising.

Among the private owners of aeroplanes in the State are the following:

Perry J. Moore Jr. of Twodot, a rancher

who has done considerable flying in Montana and California. He has a Curtiss Jennie.

Ex-Lieut. Seamore Anderson of Billings, who has made several long cross-country flights in his Curtiss JN4-D, and who recently was elected, Yellowstone County's chairman of the World Board of Aeronautical Commissioners.

Dr. Anderson of Roundup, who bought a K6 Standard in order to be able to answer country calls in a hurry.

Ed. Follensby of Helena, a garage man who is a flying enthusiast, and who bought a Canadian Curtiss for sport purposes.

Fletcher Woolston of Forsyth, who also owns a Canadian Curtiss with which he has done considerable flying throughout the State.

Ed. and Bob Westover of Billings, who purchased a Lincoln Standard Turnabout from the Montana Standard Aeroplane Co. and are doing good work in promoting civilian flying.

Mr. Hoil of Winnett, a banker who wanted fast transportation to and from the Cat Creek Oil fields, so he bought an OXX6 Standard.

The Montana Standard Aeroplane Company of Billings, is in position to furnish any information desired to pilots contemplating a flight into or through Montana this year, and will gladly extend it on request.



Where Wright Aeronautical Engines Are Made

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Approximately 7 acres, located on Main Line of Erie Railroad.

90,000 square feet.

Four floors, size 75 ft. by 300 ft. Concrete and steel heavy mill type construction, 250 pounds per square foot loading.

The plant is equipped at present to produce, and is producing approximately 300 engines per year, with spare parts therefor, and has ample capacity in addition to provide adequately for all spare part requirements for all types of engines previously produced. The equipment of the plant provides for the complete manufacture of various type engines produced, including bronze and aluminum castings, except bar steel and drop forgings. The capacity of the present plant could be expanded to produce engines at the rate of five per day in the present building. In an emergency the present acreage would allow of enough additional buildings and equipment being provided within six to eight months to produce engines of any one type in quantities of at least 25 per day.

The plant has employed during the past year an average of 450 people, which includes a complete Engineering Department and Experimental Shop.

WRIGHT AERONAUTICAL CORPORATION

Paterson, New Jersey, U. S. A.





NAVAL *and* MILITARY AERONAUTICS



Joint Training of Coast Artillery and Air Service

The War Department is taking action to insure co-ordination of the Coast Artillery and the Air Service in coast defense, under the basic principles of warfare and training recently laid down. The chiefs of the two combatant arms concerned have been instructed to consider together the question of joint training, with a view to carrying out experiments in joint training and tests of material during the coming summer.

The war with Germany furnished such an exhaustive test of the powers of mobile troops that the doctrines of training for such troops were firmly established. Coast defense, however, was not so extensively tested, and many questions of the best methods and material to be used were not solved in battle. Since the war various experiments, such as the bombing of warships, have indicated the increasing power of aircraft in coast defense. It is with a view to developing the potentialities of this new arm, as well as to insure properly co-ordinated training, that the War Department is taking action.

Both branches undoubtedly have an important role in coast defense, and tests will be for the purpose of obtaining co-ordination in their training. It is expected these tests will include:

- (a) Anti-aircraft target practice against air targets to determine the vertical range at which bombing planes could operate without being subjected to effective fire.
- (b) Bombing practice against coast defense installations.

Scott Field is Working on Two Racing Balloons

Scott Field is constructing a second balloon for competition in the U. S. balloon race which is to be held in Milwaukee, Wis., next month. The race was to have been started at Milwaukee on May 8 and the local aviation camp was to have been represented by one balloon. With the changing of the date from May 8 to May 31, permission was given to A. Leo Stevens, the civilian aeronautical officer at the field, to construct a second balloon.

The first balloon is nearing completion and the second, which will be a sister ship, has been started. The ships will be known as U. S. No. 2 and U. S. No. 3.

Each of the balloons will have a capacity of 80,050 cubic feet and will be 105 feet from bottom of basket to top of the balloon. Word of the changing of the date for the starting of the balloon race has just reached Mr. Stevens from the Aero Club of New York.

The balloons which will be entered in this year's race from Scott Field will be the second and third ships ever entered in a race. Mr. Stevens who is supervising the construction of the two ships at Scott Field also directed the manufacture of the first ship which was entered in the race at Omaha, Neb.

A large crew of men are busily engaged on the balloons at Scott Field.

The 318th Pursuit Group, Organized Reserves

The 318th Group, Pursuit, Organized Reserves, with headquarters in Indianapolis, has three squadrons, the 462nd, 463rd and 464th in Indiana (Kokomo, Wabash and Indianapolis) and the fourth, the 465th, at Louisville, Kentucky. At present there is only one Regular Army Air Service officer detailed with the Group.

The 464th Squadron at Indianapolis is the only organization nearly approaching its full complement of officers. Some enlisted men have already been signed up by recruiting officers appointed within this squadron, and all details pertaining to the squadron are being studied and rapidly mastered by the flight officers in order that the unit may begin to function as such. The remaining squadrons in Indiana have only enough officers assigned, or available for assignment, to compose a full flight in each.

The former Air Service officer presents a different problem, regarding applications for Reserve Commissions, from a line officer. The reserve line units have a more or less full quota of officers, whereas the Air Service units are sadly lacking in the available number of commissioned personnel. Being a comparatively new branch, there are no officers of long experience such as may be found in the Infantry, for instance. There are very few men holding Reserve commissions in the grade of captain, and hardly any in the field officer grade.

The work of an Air Service officer is considered very hazardous by wives and families of ex-aviators, most of whom have acquired the first named since leaving the service, so that pressure is brought to bear upon those men who would like to try their "hand" again by entering the A. S. R. C.

The majority of men now holding reserve commissions are those who completed their training just before the armistice or remained in long enough to get the rating. The old flyers look askance at the Reserve program, that is, those who have remained in touch with Acts of Congress regarding the Reserve Corps. Once a flyer, there will always be an attraction for them in flying. So to induce these valuable men to re-enter the game as an officer in the reserves, they must have a definite assurance of a sufficient amount of flying. With this assurance, it is believed there will be applications and enough men commissioned to fill the quotas desired.

The Aero Club of Indianapolis, most members of which are numbered among the personnel of the 464th Squadron, are endeavoring to acquaint all former service men, by personal contact and publicity gained in their activities, of the fact that the 464th is going to fly—and very shortly. The dedication of Schoen Field on Sunday, March 26th, was attended by all members of the organization. Schoen Field, at Fort Benjamin Harrison, is named in honor of an Indianapolis boy who was shot down overseas. This dedication marked the first official appearance of the 464th.

One steel hangar is being erected at the

field, and material for two more will arrive shortly. There will be about ten JN6H planes, one DH4B, and probably a Fokker, for use by the squadron this spring and summer. This should increase the enthusiasm and esprit not to say applications for Reserve Commissions.

Death of Major Simons and Lieut. Fitzpatrick

Two Army Air Service pilots made the supreme sacrifice in order to advance the science of aviation—Major John W. Simons, Jr., and 1st Lieut. Gerald H. Fitzpatrick, who were instantly killed near Ellington Field on April 3rd, when the planes they were piloting collided in the air.

Major Simons, who was 35 years of age, had 14 years' service in the Regular Army, being appointed a 2nd Lieutenant in the Infantry on January 4, 1908. On March 3, 1914, he was promoted to the grade of 1st Lieutenant. During the World War he was detailed a Captain in the Aviation Section, Signal Corps, in November, 1917, and he was promoted to the grade of Major on February 23, 1918.

He was sent to Rockwell Field, San Diego, Calif., for flying training, in April, 1918, and completed same on July 15, 1918, when he was rated as a Junior Military Aviator. From Rockwell Field he was sent to Langley Field, Hampton, Va., as a representative of the Bureau of Aircraft Production in command of all aircraft experimental activities at that station. His next assignment was that of Commanding Officer of Park Field, to which station he was sent in November, 1918, remaining there until September 18, 1919, when he was assigned to duty as District Material Disposal and Salvage Officer at Buffalo, N. Y.

In August, 1920, he was transferred to the Office of the Chief of Air Service, Washington, D. C., for duty as Assistant Administrative Executive. Desiring to receive further flying training, his application to take the advanced course in pursuit training at Ellington Field was approved, and he proceeded to that station in January, 1922.

Major Simons was considered an excellent pilot, and made many long cross country flights. Of a genial disposition, he was well liked by all who came in contact with him, and his many friends in Washington and elsewhere will keenly feel his loss.

Lieutenant Fitzpatrick was 24 years of age and a native of St. Louis, Mo. He was appointed a flying cadet in October, 1920; and was sent to March Field, Riverside, Calif., for flying training. He completed his primary training in April, 1921, took the examination for a commission in the Air Service, Regular Army, and received an appointment as 2nd Lieutenant on August 4, 1921, being shortly thereafter promoted to 1st Lieutenant. In December, 1921, he was sent to Ellington Field for advanced training in pursuit flying.

The Air Service sends its condolences to the bereaved relatives of these two officers.



FOREIGN NEWS



London-Brussels Service

The Instone Air Line, Ltd., has now been approved by the British Air Ministry as the company to operate a subsidized air service between London and Brussels.

Night Flight Croydon to Lympe

The first flight by night over the British portion of the Continental Air Route (Paris, Brussels, Amsterdam, etc.), was carried out by an Air Ministry machine in order to test the ground organization which has been established for commercial flying by night between London and the Continental capitals.

The aeroplane which carried eight people, including a navigator, wireless officer, and the Air Ministry officials responsible for the lighting and wireless arrangements of the route, left Biggin Hill about 8:30 p. m., flew to the London Terminal Aerodrome, Croydon, and landed there. The Pilot in charge, who has had great experience, expressed the view that the flood lighting arrangements on the aerodrome, by means of dispersed searchlight beams, together with the illuminated Landing "L's", were the best he had seen and made landing as easy by night as by day.

The aircraft left Croydon Aerodrome about 9:20 p. m. and steered a direct course for Lympe Aerodrome on the coast. Temporary Aerial Lighthouses were in action at Tatsfield and at Cranbrook, and these were easily picked up. Shortly after passing the Cranbrook Light the Pilotage Light on Lympe Aerodrome became clearly visible. The machine then flew over Lympe Aerodrome and continued over the Channel towards St. Inglevert, the first aerodrome on the French side. The Marine Lighthouse at Cap Gris Nez, which had been visible as soon as the aircraft was over Biggin Hill, gave an excellent leading mark and very soon the French Aerial Lighthouse on St. Inglevert Aerodrome also came in sight. Turning back on its course the Aeroplane then crossed the coast near Folkestone and headed direct for the Pilotage Light at Lympe at which aerodrome an easy and smooth landing was effected. Leaving this station at about 11:30 p. m. a course was retraced to Croydon, the lights of the Terminal Aerodrome being easily picked out from all the mass of lights of Croydon and London generally. After circling Croydon Aerodrome the aircraft was headed for Biggin Hill where a landing was effected with the help of wing tip flares and ground flares.

The general impressions of those who made the flight were that it is easier to find a course by night than by day and that provided the Continental ground organization is as good as our own there should be no difficulty whatever in commercial night flying over the London-Paris route.

F. Handley Page States German "Gotha" Was Copy

London—The Handley Page Co. has a claim before the Commissioners on Inventors' Awards concerning the "O" and "V" type of biplane as made by others during the war, by direction of the war-time authorities.

F. Handley Page, managing director of the company, testified in connection with the claim that the German "Gotha" was a copy of his machine and until the Germans captured a Handley Page, all complete, and were able to fly with it, they were not conversant with the structural details or convinced of the aerial dynamics in regard to big machines.

Austria: Conditions Governing Flight

In consequence of the admission of Austria into the League of Nations the provisions of the Treaty of St. Germain-Laye relating to Allied aircraft flying over Austrian territory are no longer in force.

Foreign aircraft flying over or landing on Austrian territory must be provided with a permit issued by the Austrian Ministry of Roads and Communications.

China's Air Service Wilting

Chinese "finance" was ever a thing to be marvelled at, and one of the latest enterprises to suffer at its hands appears to be the Air Service which was inaugurated last year under such favorable auspices with the assistance of Messrs. Vickers, Ltd. It seems that the cash provided, which should have gone to run the service to a commercial success, has filtered away through the Government inaptitude until nothing remains for wages, coupon interest, or anything else—without some financial miracle happens. From latest reports it looks as if the whole scheme may easily become another monument to Chinese methods of how not to do it.

London Continental Air Service

According to London newspapers, thirty new air expresses are to be "put on" the London Continental Air Service this year to cope with the great increase of traffic. The British contribution includes a number of an improved type of twin-engined Handley Page machines, each for 12 passengers. In addition, there will be a fleet of machines built by the DeHavilland Aircraft Company.

A new fleet of 14-seater Goliath airplanes will be operated by a Belgian company between London and Brussels, while a week or so hence will witness the trials of the first of a fleet of four-engined 25-seater super air expresses that one of the French companies is building. The airways are also to be extended, and instead of Paris being the terminus, it will become a junction, with services running to Marseilles, Lausanne, Warsaw and Casablanca, in Northern Africa, while it is hoped to extend the airway on the British side from London to Manchester and then across to Dublin.

Russo-German Air Traffic Company

A statement in a Russian newspaper announces the formation of a Russo-German air traffic company, which will begin operations by establishing an air route between Moscow and Königsberg, to connect with the Berlin-Königsberg express train services. An agreement has already been concluded between the Russian commercial delegation in Berlin and German interests, among whom are Herr Rathenau's organization, the General Electric Company, the Hamburg-Amerika Line, and the Zepelin Company. Germany is to recover full freedom in the matter of the construction of non-military aircraft, and the establishment of air services beginning in May.

Mexican Air Service

Trade Commissioner P. L. Bell, at Mexico City, has sent to the Automotive Division, Department of Commerce, a translation of a permit recently conceded by the Mexican Ministry of Communications and Public Works to the representative of the Cia. Mexicana de Transportes Aerea, S. A., for the establishment of an airplane service between Mexico City and points in the States of Vera Cruz and Tamaulipas. In view of similar permits ready to be granted in the near future, this one may be taken as a very good example of what parties interested in the development of commercial aviation in Mexico may expect in the way of Government permits and their conditions. It should be noted, furthermore, that this permit is not an exclusive one and does not carry the usual features of the old-time "concession."

Netherlands Market

Mr. Joseph W. Vander Laan, Secretary to American Legation, The Hague, reports that the market for American aircraft in the Netherlands is centered in the Army, the Navy and the Colonial aviation, and in the Royal Dutch Air Service Co., known abroad as the K. L. M. While the needs of the Dutch Army aviation are relatively small, and the K. L. M. has definitely decided that during 1922 it will fly Fokkers, American aircraft builders may be able to compete successfully for contracts from the Navy and the Colonial aviation.

Czechoslovakia

Engineer Janak, head of the Automobile and Flying Department of the Ministry of Social Welfare, returned from Berlin on February 17th. He concluded with representatives of the German Government a provisional agreement on a reciprocal basis regarding regular air service, passengers and goods, between Prague and Berlin. The agreement, it is said, will be signed in March. The governments of the two countries will each select a company to participate in the service, which will either be alternatively or simultaneously in opposite directions.

This means that as soon as Germany is permitted, by the Peace Treaty, to make international flights (end of 1922) German machines will be allowed to fly to Prague and over Czechoslovak territory. A new flying company will be formed at Prague, under the protection of the Legio Bank, with a capital of 8 million kronen. Deputy Rychtera will be president of this company. The amount of the government subsidy, which will be paid to this company, has not been fixed, but it is expected that it will be equal to that allotted the Franco-Roumanian Company.

This new Czechoslovak aviation company will use, as far as possible, aeroplanes of Czech manufacture. Recently the "Aero" Aircraft Factory at Prague has successfully tried out an air transport limousine, which will probably be purchased by the new aviation company. The "Aero" limousine has a wing area of 52 sq. meters and a carrying power of 40 kilos per sq. meter, weight 1300 kilos, and will have a capacity of 5 persons and 100 kilos of baggage, and will carry petrol for four hours' flight. The engine is a German 260 h. p. Maybach motor. The Military Aircraft Works are also working on an air transport limousine designed by engineer Smolik.

Prague-Vienna Service

It is reliably reported that negotiations have begun between representatives of the Czechoslovak and Austrian Governments regarding a regular air service between Prague and Vienna.

Buenos Aires-Montevideo Service

The first trip of the new bi-weekly aeroplane service between Buenos Aires and Montevideo took place on December 17th, the distance of 220 kilometers across the River Plate being covered in approximately 1 hour and 10 minutes. The aeroplane has room for four passengers. On the first return trip 1,270 letters were carried to Buenos Aires.

A very successful aviation meet was recently held in Montevideo. Two Avros, two Spads, and a Salmson were piloted by daring aviators, who thrilled the audience by corkscrew and Immelmann turns, the "falling leaf," and "looping the loop."

Honduras School

The Young Men's Club, which is interested in the advance of aviation in the country, is about to order aeroplanes from Italy for the equipment of the first Honduran School of Aviation.

Bristol Engines in France

We understand that the Bristol Aeroplane Co., Ltd., have concluded arrangements for granting the sole license to manufacture the 400 H.P. "Bristol" Jupiter radial air-cooled aero engine in France to the well-known Gnome & Le Rhone Engine Co. The announcement is of more than ordinary interest from the fact that this is probably the first occasion upon which the manufacturing license for an aero engine of British design has been acquired by a French manufacturer and is an indication of the high estimate formed in regard to the "Bristol" engines by the French aviation experts. The fact that the "Bristol" Jupiter and "Bristol" Lucifer engines are the only two air-cooled engines which have ever satisfied the strenuous conditions of the British Air Ministry Type Tests, coupled with their excellent record for reliability and performance in the air, has created a great impression in Continental aviation centers. The selling rights for the "Bristol" Jupiter engine in France and many of the countries of Europe have also been ceded to the Gnome & Le Rhone Co.

Planes Assist Seal Catching

A Grand catch of 50,000 seals is recorded from Montreal as the first week's haul of the Newfoundland Sealing Fleet, which was guided by aeroplanes to the location of the herds.

France to Have a 1922 Aero Salon

It has now been definitely decided by the Chambre Syndicale des Industries Aéronautiques that they will hold an Aero Exhibition in Paris this year. It will be, as before, at the Grand Palais, and although the actual date is not yet settled, it will probably be in December for a fortnight, although there are many who would prefer September to be the selected month.



SOARING FLIGHT

A Study of the Vulture and Colden Eagle

(Continued from page 7)

THE Eagle fears none but man, and even him he fears but little. Brought to bay, he does not hesitate to hurl himself at his enemy. In captivity he is at first exceedingly dangerous, and his ferocious temper renders him an untamable animal. It requires great skill to succeed in impressing him with fear, and when he becomes excited he will fight to the death.

Nature has created him to keep down undue increase. In this he is like the tigers, the sharks and the pike. This tyrant of the air is abundantly provided with all the weapons necessary for his murderous life. His arms consist of eight talons as long as a finger, curved and sharp-pointed and moved by terrible muscles. His much-hooked beak serves him to carve the animal perforated by his talons.

His wings are large and exceedingly strong. They are pre-eminently adapted to sailing flight. He rarely beats the air unless there is no wind, or unless he is loaded with a prey. Pen is powerless to depict the majesty of his gait, the amplitude of the immense circles which he sweeps in the air. At times he is absolutely motionless. He is examining the field or watching a prey; then suddenly he drops hundreds of yards. He falls like a meteor with the velocity of bodies falling through space.

The speed is such that it produces a sound difficult to describe. It is not like that of a bullet or of a cannon ball, but must be heard to get a true conception. Then, when within a dozen feet of earth, his wings' great strength safely checks his descent; and this at once, in half a second—merely by expanding his wings to their full spread.

His skill is wonderful; never a miss makes he. His eyes are excellent. From high up in the air he spies out the rabbit hiding in the thicket, or the inconspicuous duck swimming among the reeds. He uses his talons, the arms with which he kills, in a remarkably efficient manner. In captivity, when he is hungry, with a single claw he catches on the fly the morsels of meat thrown to him, and never misses them if they pass within his reach.

His movements have all the precision of those of small birds. He is free, quick, sharp, and powerful in his movements. Above all, his power of taking in all at a glance is very remarkable. As the motor-muscles of the eyeball are but little developed, he is compelled to turn his head whenever he desires to see anything sharply. His head then assumes splendid poses. His eye, that brilliant gem set under a deep arch, darts out lightning glances. His curved beak, his savage air, his sharp head-feathers, bristling up and forming a diadem—all that ensemble of vehement sweeping outline—make the Eagle a model of audacity and of power.

He lords it over a territory which he always selects of vast extent. All the smaller mammals dread him; the young of larger animals fear to be seen by him; the young chamois crouches up to its dam, the old bucks call the herd and stamp their feet with fury. Man himself, in infancy, has been attacked by him.

He is intelligent only from a hunting point of view. A very interesting spectacle is that of a family of Eagles making a raid in order to furnish the nest with provisions. The male is up a hundred yards in the air, quite motionless. The female is beating the thickets. Her flight while doing this has an ease of great elegance. She follows the undulations of the ground without effort, glides from one hill to another, descends and reascends the mountain slope. When a prey appears the two spouses are upon it at the same time. It often happens that a hare starting up 10 yards from the female is caught by the male, who was stationed a hundred yards away in the air. He dives head-formost, is upon the prey in four or five seconds, picking it up on the fly. If she is in the mountains, he first plunges into the valley with his load, and with great wing beats reascends to his eyrie. There the spoils are divided, and this never takes place without much dispute, despite the matrimonial bonds.

Hannover Glider Won Highest Awards

Mr. George Madelung, now connected with the Glenn L. Martin Company, Cleveland, Ohio, took part in the management and was in the Rhoen during the soaring competition held in Germany last year. In view of the statements published in AERIAL AGE crediting the highest awards to the Aachen Soaring Monoplane, Mr. Madelung points out that a glider designed by him, the Hannover, won the highest awards, which were 60 per cent more than those won by the Aachen.

As to the record breaking flight of Mr. Klemperer, which took place on August 30, 1921, this record was exceeded on September 5 by the Hannover glider which made a flight of 15 minutes 40 seconds in which it covered a straight line distance between starting and landing points of $4\frac{2}{3}$ miles.

Wing Areas and Weights of Soaring Animals

Perhaps the heaviest of the soaring fliers is the California Vulture which often weighs as much as twenty pounds. Turkeys often weigh twice this, while the albatross is occasionally found weighing eighteen pounds. Still heavier than these may have been the Pterodactyl (now extinct) which, however, weighed no more than thirty pounds.

No flying creature that ever existed appears to have been as heavy as the combination of a man with the lightest structure that can be made to support him, and this fact often has been cited as an argument against the possibility of human flight. But in this connection it is a significant fact that the areas and the power required to support a given weight steadily decrease in passing from the smaller flying animals to the larger.

The most conspicuous features to be discerned in a study of soaring bird forms are the usually extreme length and narrowness of the wings, the lower sustentation per unit of area than prevails with flapping fliers and a quite different type of curvature to the wing sections.

The pterodactyl, a bird-like reptile, which is known only from the discovery of fossil remains in strata of the Cretaceous period, measures in ordinary specimens about twenty feet from tip to tip. They were, however, very light, the wing bones that have been found being mere shell-like tubes of large diameter and extreme thinness. (The fact that there once existed a larger flying animal than any existing today has been held to prove a greater density to the earth's atmosphere in pre-historic times.) Calculations of the power exerted by this reptile in flight show that it required .036 horsepower. Its weight being thirty pounds and wing area twenty-five pounds, its weight is only 1.2 pounds per sq. ft. and 833 pounds per horsepower.

Table of Soaring Animals

Name	Weight (pounds)	Wing Area (sq. ft.)	Pounds per sq. ft.
Cabbage Butterfly .....	.000169	.00942	.0179
Maiden Dragon Fly.....	.000423	.01415	.0298
Laughing Gull	—	—	.62
Sparrow Hawk .....	.549	.69	.79
Herring Gull	2.18	2.41	1.04
Stork	4.78	4.57	1.052
Scavenger Vulture.....	—	—	1.052
Turkey Buzzard	—	—	1.052
White Pelican	—	—	1.2
Pterodactyl	30.	25.	1.30
Sea Eagle	10.57	8.05	1.456
Griffon Vulture	—	—	1.456
Eared Vulture	—	—	1.726
Condor	17.	9.85	1.76
Flying Fox	2.91	1.65	1.818
Flamingo	—	—	3.12
Albatross	25.36	8.12	3.12



RADIO DIGEST



Radio Equipped Planes

Spokane, Wash.—Radio equipment is to be installed at once in aeroplanes of the United States Aircraft corporation here, according to announcement by C. H. Messer, president.

With the equipment, capable of sending or receiving messages for 1,000 miles, the ships can be at all times in touch with the field. Receiving equipment will consist of wireless telephones. Additional safety in operation and greater usefulness will result from the installation of the phones, Mr. Messer said.

All pilots and students of the company must learn radio as a part of their course, according to Mr. Messer, inasmuch as he considers it one of the big steps in the advancement of aviation.

"By means of the wireless we will at all times be in touch with the local field," Mr. Messer said. "It will be impossible to lose the way or the sense of direction in fog or heavy smoke from forest fires."

"As soon as we have the equipment installed and under way, we will invite the public to the field to witness the demonstration of the men in the ship at a distance talking to persons on the ground."

"In addition we plan to put a receiving set in an automobile and go to all larger cities of this district and give demonstrations."

"Instruction work of a preliminary nature will be given at our Modern Auto school, but later pilots and students will give their work in the air while actually flying."

"By means of equipment we are planning to install at the field, a device known as a 'radio compass.' It is so worked that a pilot, no matter what distance he is flying, can locate his own field and tell the exact direction in which he is traveling. The equipment we will use has been given an initial tryout."

Congress to Rush Bill for Control of Radio

Congress will expedite legislation vesting control of radio communication in a general advisory board under the Department of Commerce, it was declared, following conferences of Secretary Hoover and congressional leaders.

Senator Kellogg (Minn.) and Representative White (Me.) will have charge of the radio bill now being drafted under Mr. Hoover's direction by a committee of experts.

Mr. Hoover's reports today showed that radio users are increasing at a tremendous rate and that applications of amateurs continue to pour into the Department of Commerce asking for licenses to set up transmitting stations.

Health Hints by Radio

A semi-weekly "radio telephone health bulletin service" has been inaugurated by the United States Public Health Service. It is planned to broadcast every Tuesday at 4 p.m. from the naval radio station at Anacostia, Va., a message of advice or by the average man and woman may insure continued good health. Under very favorable weather conditions it is expected that the messages will be heard on the Pacific Coast, in Europe, and the north parts of South America.

Radio Telephone Broadcasting in France

The popularity of radio broadcasting has extended far beyond our own borders. England is doing a little radio telephone broadcasting, so is Berlin, and the idea is taking real shape in France. We learn from a recent news dispatch that 20 ballet girls danced to music played 25 miles away, as a feature of a matinee. The performance was witnessed by Prof. Branley, the pioneer wireless worker, and ex-President Poincare.

Guiding Radio Waves

A Ukrainian engineer is reported to have discovered a method by which radio messages may be sent to a definite receiving station without the danger of being intercepted by other stations. It is stated that by means of a simple apparatus the so-called "locker power line" of the magnetic field may be straightened out and grouped into parallel rays. These rays are said to do away with the necessity of aerials. If this report is true, it seems that we are on the verge of a new epoch in radio. However, we shall have to wait for complete details before passing judgment on the merits of this new invention.

Medical Service via Radio

Arrangements have now been made whereby any ship provided with a radio outfit can receive prompt medical service from the United States Health Service, through one of several Radio Corporation of America stations and other stations. When it is remembered that only a small proportion of the total number of ships equipped with radio have a ship doctor, the value of medical service via radio becomes apparent. The ship in need of medical service can now call up the nearest radio station, state the nature of the case or cases requiring medical attention, and receive a diagnosis of each case and complete instructions as to treatment within a few minutes.

High-Power Vacuum Tubes

In connection with Great Britain's Imperial Chain—a world-wide radio system that has been under way for a long time—the Technical Committee recommended the use of high-powered tube installations. A considerable amount of very valuable work has been carried out in the past year by the British Admiralty, working in conjunction with the Mullard tube builders. Much progress has been made in the construction of silica tubes, which have now been made in 10-kilowatt sizes. The result of this work will undoubtedly be seen in the forthcoming year. We may expect a large number of land stations operating on valves of large power.

Crystal Acts as Valve in Receiver

The simplest radio receiving set, states Jack Binns, in the N. Y. *Tribune*, is the crystal detector, capable of receiving music and speech for a distance of twenty-five miles under practically all conditions and wireless telegraph code over very great distances.

In previous articles on this page I have described aerials of various types, protective devices for them, and the manner

in which electro-magnetic waves are produced and propagated through the ether. In this article I propose to give a description of the action of the crystal detector in the receiving set.

In the first place there are a number of ways in which the crystal detector can be used: the simplest is by placing it in series with the aerial and the ground, with the telephone receivers shunted across it. This is a very unsatisfactory method, because it does not permit one to tune out any unwanted signals, and the consequence is that a great deal of interference is obtained.

The remaining methods of utilizing the crystal can be roughly summarized under the general heading of "tuning apparatus." This may consist of what is called a "single circuit" or a "double circuit," the latter being the best of all. The single circuit may consist of a tuning coil, with one or two sliders, or a variometer, or a honeycomb coil. In the latter case a condenser in series is required in order to obtain tuning. A double circuit may consist of a loose coupler or a vario-coupler.

Now, this tuning apparatus is required in order to put the entire receiving equipment into electrical resonance with the incoming wave. This can best be illustrated by using the analogy of two tuning forks. If you get two tuning forks of exactly the same pitch and place them at different ends of a room and then strike one, the other will vibrate in unison with it. If, however, you take a tuning fork which has a higher or lower pitch it will not respond in any way to the vibrations of the other. This is exactly what happens in the tuning circuit, and the adjustments that you make put that circuit into the same "pitch" or resonance as that of the incoming wave from the broadcasting station.

It can be readily seen, therefore, that with a single circuit, which must necessarily include the aerial, as close tuning cannot be obtained as with a double circuit, for this reason: the aerial receives all waves that pass over it and the current received is passed to the ground. Those currents that are in sympathy with the aerial circuit will be recorded through the detector in the telephones. Of course, it is impossible to get 100 per cent efficiency in such tuning, and some of the undesired waves passing over the aerial will be recorded also, despite the fact that they are not of the same wave length as that to which the aerial circuit is attuned.

A double circuit means the addition of a secondary oscillating circuit. In the case of a loose coupler, this means the secondary inductance and a variable condenser shunted across it. The secondary circuit is put into resonance with the primary or aerial circuit by adjusting the number of turns in the inductance and the amount of capacity in the condenser.

It will thus be seen that while the aerial circuit may respond to some of the unwanted waves, the chances of the secondary doing so will be very remote. By varying the coupling between the primary and the secondary, these unwanted signals are still further eliminated. Similar action takes place in a vario-coupler.

This is the condition that we are now confronted with, so far as the oscillating circuits are concerned. The next job for

the receiving instrument is to record the waves that have been received. As these waves have a frequency of 830,000 cycles per second, in the case of the broadcasting stations using a 360-meter wave, it will readily be seen that they are far too high for the telephone receivers to respond to, and, moreover, they consist of alternating current. The problem is to reduce this so that the telephones can respond and reproduce vibrations within the range of human hearing.

This is the job that the crystal detector has to do, and the most sensitive of all forms of crystals used for this purpose is galena, which is a sulphide of lead found in large quantities in the Middle Western States. Galena has the peculiar property of permitting a current of electricity to flow through it in one direction only. It completely checks current flowing in the opposite direction. In other words, it acts in the electrical circuit just in the same manner as the valve does in a water pipe system. The valve permits the water to flow freely in the direction that it is desired to have the water go, but if by any chance or circumstance there should be a back flow of water the valve immediately closes and stops the back flow from going any further. Galena does the same thing in the electrical circuit.

We have now got the condition where the high frequency alternating radio currents are literally chopped in two by the detector and only half of them permitted to flow through the telephones. We have, therefore, a pulsating instead of an alternating current, and the pulsating current is flowing in one direction only. The groups of pulsations act together and cause the telephone transformer to reproduce sounds that are audible to the ear, and it is in this way that we get a reproduction of music and voice.

I have often been asked why it is that a crystal detector will receive wireless telegraph signals over very great distances, but yet is reliable so far as music and speech are concerned only over distances of approximately twenty-five miles. The answer to this question is not so difficult as it would seem. When we are dealing with telegraph code we have a current of constant amplitude sending out the dots and dashes. In other words, the "tone" or "pitch" of the signal never varies. In the case of the voice or the music we are not only dealing with varying amplitudes of sound, but we are also dealing with loud and soft inflections.

Lightning Danger to Antenna Small

If your radio installation is not already installed according to regulations you should attend to the matter at once, says G. K. Thompson radio superintendent of the Amrad Co., in the *New York Herald*. The regulations are in force the year round and should be complied with as far as possible. That they are not complied with is a well known fact, but this negligence means that after the first thunderclap thousands of people will storm dealers in radio equipment for protective devices and their meager supplies will be exhausted within a few hours.

One of the first questions that comes into the mind of the would be radio user concerns lightning. "Will my antenna attract lightning and cause my home to be struck?" he asks. To the general public wireless and lightning seem to be twin brothers—probably because the manifestations of both are uncanny and mysterious.

Hoisting a radio antenna over your property does not endanger your dwelling, your instruments or your family if a few

simple precautions are observed. You have never felt apprehensive over the presence of the telephone wire running from the pole on the sidewalk to your house. You do not regard the bell wire circuit running from the front door to the kitchen as a lightning conductor, nor have you been nervous over the presence of a wire clothesline in your back yard, the tin roof over your head or the metal gutters and leader pipes.

All these common and familiar metal surfaces and conductors will convey electricity from point to point. The average radio antenna differs very little from these other conductors and objects, and in so far as lightning is concerned the radio antenna is much less likely to be struck during a heavy thunder storm.

Let us consider the electrical action that takes place in the antenna before and during a summer thunderstorm. There is always a certain amount of atmospheric electricity present in the air. In cold weather the amount is very slight and manifests itself in the radio set by what is familiarly known as static. When warm weather comes atmospheric electricity is generated in much larger quantities.

The intense heat of the summer sun evaporates the moisture on the surface of the earth and water from ponds and lakes very rapidly. This evaporated moisture or vapor, becoming heated, rises to the upper atmosphere and upon reaching the higher levels, where the temperature is lower, the water vapor condenses into minute drops of moisture and forms clouds. Each moisture particle becomes charged with a very small amount of electricity.

As the moisture particles in the upper air become more dense the particles crowd together and one particle combines with another. This combination increases the electrical charge on each particle until finally a thunder cloud is formed which is very highly charged with electricity.

It is a known fact that when thunderstorms are in formation electric discharges occur within the cloud. These discharges are popularly known as sheet lightning. Every time such a discharge takes place radio waves are emanated and these waves impinge upon your antenna, causing a sharp crash or crackle in the telephone receivers if you happen to be listening in.

A thunder cloud must be regarded as a huge bubble containing electricity. Discharges are constantly taking place within the bubble and increasing in size. When a certain critical point is reached the bubble bursts, the pent up electricity discharges in one swoop to the earth and we hear a mighty thunder-clap. If this lightning bolt strikes within one-half mile of your antenna, considerable current will be induced in your aerial system. This induced current will pass harmlessly to the ground and you will be unconscious of its presence if you have taken the proper precautions.

Let us consider the great bubble once more. If we prick tiny holes in this bubble while it is in process of formation, the pent up electricity will gradually discharge. If we prick enough holes in the bubble, the electric charge may leak away so fast that the quantity of electricity within may never reach the point where the bubble will burst. The function of the common lightning rod and the properly grounded or protected antenna is to prick holes in the great electric bubble in the sky and convey its charge silently to the ground. For this purpose the average radio antenna is exactly as effective as the lightning rod.

"What will happen if a lightning bolt actually strikes my antenna?" is a familiar

question. Let us consider the nature of a lightning bolt. The heavy thunderclap which attends its appearance gives the impression of tremendous energy.

It is true that lightning is destructive but as a matter of fact its bark deceives one of its might. The average lightning bolt contains about as much energy as represented in a pint of gasoline. The only difference is that the energy of lightning is exerted instantaneously.

Take, for instance, a cupful of gasoline and ignite it under a saucepan containing a tallow candle. The heat of the burning gasoline will melt the candle. The phenomenon is silent and harmless. Take another cupful of gasoline and dump it into the gas tank of the family flivver, crank up, and drive thirty miles an hour, head on into a concrete wall. The effect is startling.

Even Henry Ford himself could not put together the remains and make them rattle once more. Yet the energy involved was no more than that necessary to melt the tallow candle.

A bolt of lightning represents an electrical collision. This accounts for its many strange antics, such as stripping the soles from shoes of persons struck, smashing crockery or ripping off wall paper.

Uses Electric Main to Pick Up Chicago

Few amateurs in this part of the country even with the best of aeriels have been able to pick up KYW, the Westinghouse station at Chicago, not alone because of the air line distance of more than 700 miles, but also because of the interference of nearer stations on the same wavelengths. At least one radio listener in the city, however, who operates without any aerial on his roof, has caught the fleeting strains of the Illinois station.

Thomas C. Shotwell of 611 West 156th street, who has taken down his aerial and for more than a month has been getting all his concerts from an electric light socket, succeeded the other day in picking up KYW, but before long WJZ came crashing in from Newark and KYW ceased to sing. Other amateurs, following in Mr. Shotwell's footsteps by using an electric light socket, also have reported good results, but the system, as described by the Washington Heights experimenter does not work in all sections of the city and is not of value in the case of crystal detector sets.

Where the electric light mains are not grounded, attaching the antenna lead to only one of the two wires in the socket will not direct an electric current to the set, but where the mains are grounded there is danger that a current will shoot through the set, burning it out. Amateurs therefore must proceed with the greatest care.

Mr. Shotwell suggested the possibility that the power house, in his case half mile from his home, may act as a huge regenerative element picking up the messages and giving them radio amplification. In this case, he said, the electric light wire would simply conduct the waves, as in the case of Major-Gen. George O. Squier's wired wireless, to the receiving set. The electric light wires run underground through the walls of the Shotwell apartment house, so that Mr. Shotwell cannot understand how it is that they act as a better aerial than the antenna he previously had on his roof.

Mr. Shotwell uses a Grebe CR6 set with radiotron detector and two stages of amplification.

THE PETREL

was tested on March 3d, off the ice on the St. Lawrence River. It exceeded the performance specifications in speed, climb, and every other detail.

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All enquiries promptly dealt with.

Write in and state your requirements

(Concluded from page 177)

glass and automatically lighted in a certain order according to the direction of the wind. Such a system is possible, but very expensive.

The French organizations have tested another method for night landing. An oblong portion of the field is illuminated by a series of special searchlights in such a way that the major axis of the geometric figure formed by this illuminated portion lies in the direction of the wind. A red light placed beyond one end of this illuminated portion indicates the direction of landing, in order that all confusion may be avoided. The attached table gives the various signals employed on landing fields by day and by night.

3. Signals for Foggy Weather.—Since visual signals are useless in foggy weather, it is necessary to substitute sound or electro-magnetic signals. The use of the former is very limited, for the noise of the engines prevents their being heard on board. The latter are being investigated.

Conclusions

Regular and reliable aerial navigation is only rendered possible by the use of a suitable system of communications, signals and beacons along the air routes. These routes are nearly all international. The installation of their communications and beacons is therefore an international question and it is of the greatest importance for their development to have the various governments reach a complete agreement concerning the manner of establishing them. It is to be hoped that exchanges of views and discussions will increase between both private and public organizations for the development of aeronautics in the different countries. This can but help prepare the way for international agreements and hasten their realization.

Significance of signal	Day Signals	Night Signals		Sound Signals
		Lights	Rockets	
Sent by the Aeroplanes				
Request for permission to land		Intermittent and indicative signals with one green lamp	Green rocket	
I am going to land		Short intermittent signals with navigation lights	Red rocket	
Distress	N. C. flag signals of the International code and distance signal	S.O.S. with any light	White rockets at short intervals	Continuous sound with any device
Sent from the Ground				
Permission to land		Indicative and intermittent signals with green lights (green cross)	Green rocket	
Landing forbidden		Red lights (red cross)	Red rocket	
Turn to the left	Red barrier	Circle of red lights		
Turn to the right	White barrier	Circle of green lights		
Obstacles of less than 15 meters		Isolated red lights		
Obstacles of over 15 meters		3 red vertical lights 3 meters apart		
Entrance of the slip of a seaplane base		Row of 3 lights 1 white between 2 green		

(Translated by the National Advisory Committee for Aeronautics)

AERIAL AGE

WEEKLY

Vol. 15, No. 9

MAY 8, 1922

10 CENTS A COPY

Raymond D. Harris
Including Radio Section



City Hall Section of New York City. Photographed by the Fairchild Aerial Camera Corporation

**Spring Flying Meet—Rates in France
to be Cut for Tourists—Maps and
Navigation Methods**

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Correspondence with Distributors invited

May 8, 1922



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OL. XV

NEW YORK, MAY 8, 1922

No. 9

Spring Flying Meet

A SPRING flying meeting held as a benefit for the Veterans' Mountain Camp attracted a crowd of more than 20,000 on April 30 to Curtiss Field, near Mineola, L. I. Foremost pilots in the country participated in events designed to demonstrate the fine points of the season's new models of aeroplanes. Twenty planes competed in the various races and stunts. Between events pilots took spectators up for short hops around the field.

Otto H. Kahn, Assistant Postmaster General Paul Henderson, Major Gen. Mason H. Patrick, Chief of the United States Air Service, and Augustus Post, veteran balloonist, were among the spectators. The show was under the auspices of the Rotary Club of New York, assisted by the American Legion, the Aero Club of America, the Aeronautical Chamber of Commerce and the Curtiss Aeroplane and Motor Corporation, the last named, owners of the flying field.

Before the meet started Bert Acosta flew the Curtiss "Wildcat" at a speed of 208 miles an hour. The official world's speed record, established in France, is 203 miles an hour. As Acosta's feat was not officially recorded, it cannot be taken as a record.

There were ten contestants in an eight-mile flight over a hilly course. John Miller in a Curtiss Oriole won the first prize of \$150, William Gillmore, second prize, \$100, and Henrique, third, \$50.

The spectators seemed to take the greatest interest in the performance of the Mummert, described as the smallest plane in the world. This plane has a wing spread of only eighteen feet and a length over all of twelve feet. Including the pilot, its total weight does not exceed 550 pounds, according to H. C. Mummert, the designer and builder. It was observed that only a short, thin pilot could sit in the tiny cockpit of the Mummert.

Contrasting with the Mummert was a huge Handley-Page bi-engine plane, seating twelve passengers in its enclosed saloon. This plane, which was manoeuvred with seemingly remarkable ease, has a wing spread of ninety feet. During the afternoon the plane made several flights with invited guests as passengers.

One of the earlier Curtiss planes, which won the Gordon Bennett race in 1911, was flown at the meet and focussed attention on the strides that have been made in aeronautical development. The pilot, sitting on a bicycle-like seat, seemed suspended in the air. The manoeuvrability of this machine won the admiration of pilots about the field.

The postal air mail had six planes at the field for the inspection of the public. Assistant Postmaster Henderson, who is in charge of the air mail, announced that probably during this Summer aerial night flying mail service between New York and San Francisco would be established.

"The Air Mail Service cannot be improved without night flying," he said. "I am at present at work planning emergency landing fields across the continent at thirty-mile intervals. These fields will be lighted with beacons and flares, the latter turned on when a plane desires to land. The air mail planes will be equipped with radio directional finders and radio telephone."

Major Gen. Patrick, while watching the flying, called attention to the advance of the Orient in demonstrating the utility of the aeroplane in attack. He said what the Chinese had accomplished the latter part of the week was significant and prophetic of what would happen in wars of the future.

Rates in France to be Cut for Tourists

WITH the assurance that at least 300,000 Americans will cross Europe this season, most of whom will want to have as much time as possible in traveling across France, Belgium and Germany, aeroplane companies here are preparing to slash prices in an unprecedented battle for clients.

Already the companies crossing the Channel have lopped off 50 francs and are considering another decrease early next month which will bring the cost to the level of that of first class railway and steamship accommodations, with a saving of at least five hours between London and Paris.

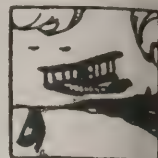
Not only is this arrangement to apply to the regular schedules but the air station at Le Bourget is being equipped to accommodate at least 200 planes, which will be ready to leave in any direction at any hour, with pilots certified by the French Government.

The machines will be big enough to take ten passengers each in the great rush which is expected late in the summer, when trains are overcrowded and there are the alternatives of standing up all night or altering plans to visit the most cherished scenes.

Travelers generally, however, will find the railways anxious to give better service than last year. Although the rail tariff has not yet decreased, officials declare they are preparing for tourist traffic on a greater scale than ever before.



THE NEWS OF THE WEEK



Captain of R-38 on Visit Here

Capt. Archibald H. Wann, who was in command of the giant British dirigible R-38, which was to have been known as the American ZR-2, when she fell into the Humber River at Hull, England, last August, carrying sixteen Americans to death, arrived recently on the Celtic.

Capt. Wann was accompanied by his brother, Major James Wann, also of the British Air Service. He was extremely reluctant to talk about the accident to the R-38, but admitted he had confidence in such dirigibles and looked forward to the day when they would be safe for travel.

"England hasn't given up building dirigibles," said Capt. Wann. "Her failure to build them now is due to lack of money and not lack of confidence. There must be accidents when experimenting."

He pointed out that Germany had fourteen very serious accidents before she successfully used the Zeppelin in the World War. Capt. Wann is here in an unofficial capacity. He and his brother came to this country to visit another member of his family, who is in business in this city.

Aviators' Ball in Airdrome Setting

The fourth Aviators' Ball was held at the Astor, New York City, April 24, and was largely attended, with a brilliant representation of society and officialdom from the State and New York National Guard. The ball was opened with military ceremonies, Mme. Eleanor de Cisneros singing the national anthem. Many high ranking army and navy officers and the presence of most of the allied aviators in uniform, with their decorations, marked the military and patriotic of the ball.

The ballroom of the Astor was transformed into an airdrome, somewhere in France, for the ball, and represented the landing field, with the national colors at one end and the air direction sleeve, a part of every airdrome's equipment, at the other. An electrical cloud effect and numerous miniature aeroplanes added to the realism of the background.

Many dinners preceded the function, among the dinner hostesses being Mrs. T. J. Oakley Rhineland, Mrs. E. N. Breitung, Mrs. George D. Yeomans, Mrs. Malcolm Sloane, Mrs. Edwin Shattuck, Mrs. Harry Harkness Flagler, the Misses Barbara Brokaw and Dorothy Collins. Colonel Laurence L. Driggs, general Chairman of the ball, also entertained at dinner.

A feature of the evening was a pageant of the air presented under the direction of Francis Markoe, assisted by the Misses Dorothy Collins, Barbara Brokaw and Marjorie Cleveland. Those who took part in the pageant were the Misses Constance Banks, Elizabeth Andrade, Beatrice Batterman, Phyllis Batchellor, Alice Beadleston, Harriet Camac, Dolores Carillo, Nina Chatillon, Elizabeth Clarke, Florence Clendenin, Margaret Davison, Emily Dodge, Mrs. Henry Rogers Benjamin, Mrs. Howard Burdick and Mrs. Fal de Saint Phalle.

Incidentally professional dancers from current theatrical attractions appeared. Mlle. Stasia Ledowa, premiere danseuse of the Chicago Opera Company, danced "The Day of a Butterfly."

Mrs. Charles Dana Gibson was Chairman of the Patroness Committee. Among

the patronesses were Mrs. Henry M. Alexander, Mrs. Cortlandt Field Bishop, Mrs. Robert Bacon, Mrs. John Barber, Mrs. Charles de Rham, Jr., Mrs. Newbold LeRoy Edgar, Mrs. Marshall Field, Mrs. Henry H. Flagler, Mrs. R. Horace Gallatin, Mrs. Jay Gould, Mrs. E. H. Harriman, Mrs. F. Burrall Hoffman, Mrs. Goodhue Livingston, Jr., Mrs. John Purroy Mitchel, Mrs. Theodore Roosevelt, Jr., Mrs. H. Rivington Pyne, Mrs. Herbert Shipman, Mrs. Henry Rogers Winthrop and Mrs. Charles C. Rumsey.

Monmouth Flying Meet

A flying meet will be held at Monmouth, Illinois, June 15 to 17th by the Monmouth Aero Club assisted by The Curtiss Iowa Air Craft Corporation of Fort Dodge, Iowa, owners and operators of the flying field at Monmouth. Major R. W. Schroeder will act as judge of the meet and will fly to Monmouth from Chicago with Mrs. Schroeder.

Many prominent fliers and manufacturers have accepted invitations to attend this meet and there is every assurance that it will be the biggest event of its kind ever held in Illinois outside of Chicago.

Major F. H. LaGuardia Addresses Aeronautical Executives

On Friday, April 21st, the Executives of the Aeronautical Companies in the vicinity of New York attended their seventh semi-monthly luncheon at the Café Boulevard.

Major LaGuardia was introduced to those present by the Chairman, Mr. R. R. Blythe who stated in his introduction that as the Major has been for years in political prominence and recently Colonel of the New York Aerial Policy, that his brilliant career was known to all.

"The future of Commercial Aviation is merely a question of time," pointed out Major LaGuardia. "There is no doubt in my mind but that we are on the verge of a very great development in Aeronautics; this, nevertheless, must come from within the industry itself. We cannot expect future large appropriations from the Government to sustain orders for planes and motors and thereby tide the industry over to better times. As times goes on the Government orders will be decreased, the aircraft budget will be cut to a minimum.

During the War when the Government took over the railroads there was a great deal of criticism for the Administration, but few people realized that the Government agreed to pay five per cent. interest on all the railroads' funded debt. In this, to a great extent, was the Government Railroad deficit increased. Now, just as the railroads were taken over in the past so will they be again in the future owing to the fact that slowly the interest on the railroad debt is mounting up and it is becoming increasingly harder to operate at a reasonable cost. When freights become excessive the Government will have to take a hand; the waterways of the United States will be utilized for slow freight, trains for regular freight and aircraft for express.

"Passenger carrying," said Major LaGuardia, "is the least remunerative of any form of transportation, it incurs greater expense, improved facilities, and more space than express or freight.

"It therefore, remains that those executives in the industry who are desirous of more rapid development to secure Government Mail Contracts and cater to fast press. Time and confidence will bring the passengers to our Central Air Depots.

The Portugal-Brazil Flight

Rio de Janeiro—The Portuguese aviators who were attempting a flight from Portugal to Brazil, will be unable to proceed in their hydro-aeroplane from St. Paul Rocks, a few hundred miles short of their goal on the American Continent where they landed April 18 because of damage to their machine, according to Havas dispatch from Pernambuco.

The message says their hydro-aeroplane was so badly damaged in effecting the landing that it is no longer usable. The aviators, however, expect to save the motor.

Another agency dispatch from the island of Fernando de Noronha, confirming the loss of the hydro-aeroplane, says the aviators are ready to resume their voyage and are confident of successfully completing it if the Government will furnish them with another machine.

Captains Coutinho and Sacadura started from Lisbon March 30 on their attempted flight to Brazil. Their first jump was to Las Palmas, in the Canary Islands, 70 miles, which they covered in seven and one-half hours. Delayed several days by bad weather, they finally hopped off from Gando Bay, in the Canaries, on the morning of April 5, for the Cape Verde Islands some 800 miles distant, and reached St. Vincent, in the Cape Verdes, that afternoon.

There was further delay at these islands while favorable weather conditions were being awaited, but at 5:50 o'clock Tuesday morning, April 18, the aviators took off from Porto Praya, in the Cape Verde for St. Paul Rocks, about 900 miles distant, in mid-Atlantic. They reached the destination at the rocks at 8 o'clock Tuesday evening, but had a misadventure landing. The dispatches Tuesday night, however, reported their machine was only slightly damaged.

From St. Paul Rocks the aviators intended flying to the islands of Fernando de Noronha, off the Brazilian coast, at replenishing their gas supply. The neglect of their flight would have brought them at Fernando de Noronha, within about 275 miles of Pernambuco, their intended destination.

The Aeroplane as a Time Saver in Business

One of San Francisco's most successful business merchants, Mr. James Otis, whom time, in a very literal sense, means money, realizing the value of the aeroplane as a successful saver of silver seconds, substitutes for a high-powered roadster which to travel from place to place on important business missions, his 2-passenger Ansaldo "Airster." Through the courtesy of Mr. Otis, several ladies of Crissy Field were treated to a "hop" in the Ansaldo recently. One or two of the intrepid aviatrices were seasoned aerial navigators—they had been up at least once or twice before! The Ansaldo "hop," however, provided the others with their initial airplane "thrill."

The AIRCRAFT TRADE REVIEW

American Air Service Company Plans

Major Charles J. Glidden, President of the World's Boards of Aeronautical Commissioners, Inc., at the banquet of the Publicity Club at Springfield, Mass., said:

"After inspecting the landing fields—and possibilities of Springfield, that on account of its geographical position Springfield is bound to be a distributing point for Air Mail Merchandise and passengers to all parts of New England States to points in Vermont, New Hampshire, Eastern, Central and Northwestern Massachusetts points; also Maine and the North Eastern Provinces as far as New Brunswick and Newfoundland, and Canada from Montreal to Three Rivers and Quebec.

"The aeroplanes from New York will fly express to Springfield, where the merchandise will be transferred in hampers and the mail in sacks to planes covering the area above mentioned. Therefore it is very important that Springfield should keep close in touch with the aeronautical movement.

"The Committee on Investigation and Organization of the American Air Service Company to be incorporated to operate a line from New York to Chicago and the Pacific Coast are making splendid progress. This committee of which I have the honor to be Chairman was appointed at the Biltmore Hotel meeting February 11th. The meeting was addressed by Mr. Milton A. Stone of your City and Chairman of the World's Board of Aeronautical Commissioners, Inc., for Massachusetts, Congressman Steenerson, Chairman Committee on Post Offices and Post Roads, special representatives sent to the meeting by the Postmaster General, Secretary of the Navy, and others.

"This line will be extended to Springfield, Boston and the Provinces, and we hope to start a daily test service within the next sixty days each way between New York and Chicago, carrying first, mail and merchandise, later passengers.

"The ships will fly at night, leaving Chicago and New York about midnight, arriving in the early morning. Bankers say this will save \$100,000 daily in interest charges on bank clearings.

"Following the test flights, permanent service will be established between New York and Chicago. The test flights will then be put into operation between Chicago, San Francisco, Los Angeles, Seattle, New Orleans and other points."

General Theory of Thin Wing Sections

This report (No. 142) of the National Advisory Committee for Aeronautics by Max M. Munk deals with a new, simple method of calculating the air forces to which thin wings are subjected at small angles of attack, if their curvature is not too great. Two simple integrals are the result. They contain only the coordinates of the wing section. The first integral gives the angle of attack at which the lift of the wing is zero, the second integral gives the moment experienced by the wing when its angle is zero. The two constants thus obtained are sufficient to determine the lift and moment for any

other angle of attack. This refers primarily to a two-dimensional flow in a non-viscous fluid. However, in combination with the theory of the aerodynamical induction, and with our empirical knowledge of the drag due to friction, the results are valuable for actual wings also. A particular result obtained is the calculation of the elevator effect. The following is an outline of the subject as treated in this report:

- I. Introduction.
- II. Calculation of the elevator effect.
- III. General formula for any section.
- IV. Examples of the zero angle.
- V. Thin sections with upper and lower boundaries.
- VI. The moment coefficient.
- VII. Examples of the moment coefficient.
- VIII. Table of the sections investigated.

A copy of Report No. 142 may be obtained upon request from the National Advisory Committee for Aeronautics.

Progress of Aeronautics in Congress

The Aeronautical Chamber of Commerce has prepared the following memorandum concerning the progress of aeronautic matters in Congress.

March 13, *Senate*.

Mr. McKellar introduces S. J. Res. 175 relative to the purchase of aircraft from any foreign nation, citizen, or corporation.

March 21, *House*.

Executive document 572, transmitting supplemental estimate of appropriation for the Navy department for the fiscal year ending June 30, 1923, for salaries: "Bureau of aeronautics" 56,010, as a substitute for the estimate contained in the Budget of \$43,310, and for "care, custody, and operation of the naval petroleum reserves," \$100,000 (H. Doc. No. 218); to the Comm. on appropriations.

March 22, *House*.

Mr. Larsen introduces into the record a letter from an attorney (H. W. Driscoll) to an aviator suggesting that he appoint him attorney to collect back pay made possible by a recent decision of the Court of Claims. The fee was to be one-third of the amount collected. For all the cases involved as a result of this decision, the lawyer would receive about \$1,000,000 for his services on the basis of one-third of the amount collected.

March 24, *House*.

Army appropriation bill debated. The need of helium investigated and more extensive experimental work at McCook Field debated.

March 29, *Senate*.

Mr. Hurd in discussing the Naval Disarmament Treaty emphasizes that the day of the battleship is over and that the aeroplane is one of the new weapons of warfare.

April 3, *Senate*.

Mr. Walsh of Massachusetts introduces a Resolution (266) proposing the establishment of a school of aeronautics.

April 5, *Senate*.

Mr. Walsh's resolution (see above) read again and laid aside for more complete data.

April 6, *House*.

Mr. Steenerson (H. R. 11193) to encourage commercial aviation and authorizing the Postmaster-General to contract for air mail service and prescribing rates of transportation and postage thereon; to the Committee on the Post Office and Post Roads.

April 11, *House*.

Mr. Woodruff introduces a resolution authorizing a Committee to investigate war contracts and expenditures. Brings into the discussion the subject of aircraft contracts.

April 12, *House*.

In discussing the the navy bill (H. R. 11228) the question of the no. of personnel in the navy service was brought up. Mr. French believed there was no basis of comparison between the British air force and the American as the British was an offensive force and ours is a defensive force.

April 18, *House*.

In discussing the Navy appropriation bill (H. R. 11228) the aviation appropriations were discussed. The bill calls for a total of \$7,866,950. Mr. Hicks offered an amendment increasing the sum provided for overhauling planes from \$5,475,000 to \$7,093,000.

April 19, *House*.

Amendment of Mr. Hicks rejected (See above).

COMING AERONAUTICAL EVENTS

AMERICAN

- May —National Balloon Race.
- Sept. 4.—Detroit Aerial Water (about) Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
- Sept. 15.—Detroit Aerial Derby, (about) Detroit. (Pulitzer Trophy Race.)
- Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

- Aug. 1.—Coupe Jacques Schneider. (about) (Seaplane speed race.) Italy, probably Venice.
- Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.
- Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

MAPS AND NAVIGATION METHODS

By A. DUVAL*

BEFORE undertaking any voyage, however short, the aerial navigator provides himself with the necessary maps. This is an easy matter in our country, where there is a wide choice among the various maps published by the Geographic Section of the Army, the Department of the Interior and the Aero Club.

When it is a question of a trip into a foreign country, the case is no longer the same. In some countries the only existing maps are incorrect or poorly edited, while in others they are comparable with ours, but French navigators, not being accustomed to their scales, nor to their colors, nor to their special manner of presentation, do not find them convenient. Reciprocally, foreigners experience the same inconvenience in using our maps. The most commonly used map is drawn on the scale of 1 : 200,000. This gives the most details of interest to the aviator, without taking too much paper. The 1 : 1,000,000 scale is useful for long voyages. It is always best to carry the corresponding maps on the 1 : 200,000 scale, for the aerial navigator sometimes has occasion to identify details not shown on the 1 : 1,000,000 map.

These two maps are not specially made for aviators. It seems therefore that the solution of the problem has progressed hardly any since Mr. Lallemand, member of the Institute, asked for the creation of aviation maps. This delay is explained by the fact that during the war the existing maps (1 : 200,000 of the Geographic Section of the Army, and 1 : 126,720 of the Ordnance Survey) were satisfactory to the aviators of the allies, who flew in restricted sectors and seldom made long voyages.

Now the requirements of civil aeronautics, the chief object of which is to make voyages are different and depend on aviation maps. This fact did not escape the attention of the experts who drew up the international agreement of October 13, 1919, containing regulations for aerial navigation. Annex F, of this agreement or convention, made provision for various international aviation maps, which the contracting countries will publish within a few years. Already three of the most enterprising nations have agreed on the details of execution, as we shall see further along.

Anyway, it is not out of place to call attention to the scope of the task undertaken, as well as to the value of the preliminary work accomplished since 1919. If the aviators, who are wanting aviation maps worthy of the name, had any idea of the work accomplished, their very natural impatience would be less prompt to manifest itself.

Under the respective designations of normal maps and general maps, the convention established two types of international aviation maps. In principle, they must be made according to the rules adopted for the 1 : 1,000,000 map of the world, with the metric system of measurements. Each country, however, has the privilege to add its own units of measurement to the maps it publishes.

After discussion during the English-French-Belgian conferences of 1920 and 1921, the details of the conventional symbols were fixed. Since their exposition lies outside the scope of this article, we will confine ourselves to a general description of the two kinds of maps provided for.

General maps.—The general map is made according to Mercator's projection, one degree of longitude being represented by a length of three centimeters, which gives, in our latitude, an average scale of about 1 : 2,000,000. Each folio contains a complete number of sections of the map of the world on the 1 : 1,000,000 scale, which is generally nine for latitudes below 60°, six and even three for higher latitudes. Each side of each sheet covers 1° in latitude by 2° in longitude. There is a common portion on adjacent sheets, which facilitates the passage from one sheet to the next.

The relief is indicated by hypsometric tints supplemented by altimetric figures and, where there is occasion for it, by a slight shading. This method of representing the relief is in conformity with the 1 : 1,000,000 map of the world. It enables the aviator to choose instantly, without risk, the altitude of safety, in case of poor visibility. Any representation of relief, accomplished simply by means of shading and altitude figures, does not offer this advantage, since the navigator must read all the altitudes of a region in order to determine the altitude of safety. He runs the risk of overlooking that of the summit, against which he is in danger of crashing. The necessity of judging the altitude of the whole region led to the use of

hypsometric colors for the general map. It is omitted on the normal maps, where each section bears on its margin the altitude of the highest point and of the lowest point in the region represented. The relief of the normal map is also shown by shading.

Lastly, general maps are only provided for continents. Aviation maps are not necessary, in fact, for the oceans, for which the aeronaut will use marine maps based on Mercator's projection.

Normal maps.—These are published on the scale of 1 : 200,000. The kind of projection is not stipulated. This is because, on the one hand, the various projections differ but little on this scale and because, on the other hand, of the great advantage of being able to make use of much existing cartographic material.

Each section of the normal map embraces 1° in longitude and 1° in latitude. They will doubtless overlap one another by several kilometers. The relief is indicated by shading, supplemented by altimetric figures.

Miscellaneous maps.—The object of the convention was to create a set of identical aeronautic maps for the whole globe. Aside from these standard maps, the aerial navigator may use any others. Let us note, in passing, the 1 : 200,000 map of Capt. Hebrard and Lieut. Robbe, on which the roads stand out light against a dark background. The advantages of this method will be manifest, when night flights become common.

Maps are indispensable for the aviator. Their conception, however, depends on the methods employed in aerial navigation, which we will now endeavor to set forth.

"To navigate is to go from one point to another by the shortest and easiest route." This applies to both water and aircraft.

Aerial navigation, although freely accomplished in three dimensions (with certain restrictions in the vertical direction) is in all points comparable with maritime navigation. On the contrary, it is not comparable with the means of land transportation.

In fact; there are two methods of navigating an aircraft:

1. To fly with continuous reference to landmarks;*
2. To take a direct route by the compass, with only occasional reference to the ground for determining the position of the aircraft.

The former method, which is chronologically older, is still commonly employed. Although comprehensible in the beginnings of aviation, when only the pilot was on board and the voyages were of short duration, it is now an anachronism. To be compelled to follow a railway or a river is a loss of time. This method is, moreover, not very safe, for as soon as the pilot loses this "thread of Ariadne," he is lost. Errors have been frequent at cross-roads and junctions. Lastly, it is well to note the danger resulting from this practice. On a given aerial route, all the pilots would follow, in cloudy weather, exactly the same landmarks, thus creating great risk of collisions.

The second method, successfully employed on aeroplanes and airships by several crews, has stood the test for centuries in all navies. It is therefore no novelty, but merely an adaptation. By means of the compass, the pilot steers the aircraft in a constant direction with reference to the meridian. The path thus described is a loxodromic or rhumb line.

Hence, to steer by the compass is to describe a loxodromic curve. The pilot only needs to choose the one which connects his starting point with his destination, and then to make sure from time to time that he has not departed from it and, lastly, to verify his speed.

The use of the compass renders it possible to follow the most direct route between two points and especially to lose sight of land without inconvenience, for a certain length of time. At any instant, the navigator can determine his position by "dead reckoning," with the aid of his absolute speed and the time elapsed.

The accuracy of this method depends on the pilot's skill in using his compass and on the exactness of his knowledge of

*Some authors make a distinction between following a continuous reference line (highway or railroad) and flying from one reference point to another by comparing the ground and the map. This is a distinction without a difference, since in cloudy weather they lead to the same result, flight near the ground.

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*From "Premier Congrès International de la Navigation Aérienne," pp. 150-155, Paris, November, 1921.

the data employed, namely, the angle of the route followed and the absolute speed. The route angle is the angle formed with the meridian by the loxodromic trajectory described on the earth by the aircraft which is steered with the aid of the compass.

As often as possible, this dead reckoning will be verified by observations of terrestrial or celestial reference points, or other method (radiogoniometry, etc.).

Usually the wind causes the aeroplane to drift (uniformly, if the wind is regular). The angle between the axis of the aircraft called the course, and the route actually followed is the angle of drift. The pilot must therefore endeavor to determine the course to be adopted so that the drift will cause him to follow the loxodromic line traced on the map. Practically, for holding the aircraft on this course, the pilot must determine opposite what graduation of the compass rose he must hold the reference mark which indicates the position of the axis of the aeroplane. The compass course is obtained by correcting the given course by the angle of "variation." This variation is the algebraic sum of the magnetic declination (angle formed, at any given place, between the geographic and magnetic meridians) and the deflection caused by the iron of the aircraft, which affects the magnetized compass needle. The declination is always exactly known. As to the deflection, an endeavor should be made to eliminate this once for all by "compensation," the explanation of which lies outside the scope of the present article. It is a very simple and practical operation. When properly executed, the residual deflection is very small (1° to 2°) and the directive force of the compass remains constant for different courses.

The only difficulty encountered in following a loxodromic or rhumb line is therefore the determination of the angle of drift. By means of aerological soundings, this is easily determined before starting. The data for calculating the course then remain exact so long as the wind does not vary. If the wind is found to change, it becomes necessary to change the course steered or be driven off the true route. During the voyage, the navigator must employ one of the two following methods for determining the drift.

1. Determination, on the map, of two successive positions of the aircraft and of the exact route followed between these positions.

2. Instantaneous measurement of the drift by the observation of some point on the earth.

The first method utilizes what some call "navigation by observation," in which the navigator steers by calculation, which he rectifies by every observation made. He thus describes a series of loxodromic lines each one starting from the last point observed.

The second method of measuring the drift necessitates a brief view of the earth, without its being necessary, however, to identify any given reference point. It consists in measuring the angle formed by the apparent motion of the reference point and the course of the aircraft. This measurement can be made, even when the reference point does not pass directly under the aircraft. The S.T.Ae. (Technical Section of Aeronautics) drift-meter and the Le Prieur "navigraph" are based on this principle. Moreover, the results are faithfully preserved, which constitutes a great advantage, since two successive drift measurements with different courses give the magnitude and direction of the wind.

The absolute speed is measured: either by noting the time taken to traverse the distance between two observed points, which are shown on the map; or instantaneously by making measurements with reference to a single point, which does not need to be identified.

For utilizing the latter method, we may employ the navigraph, the S.T.Ae. drift-meter, or the Le Prieur "cinemograph."

In the S.T.Ae. drift-meter, there are two sighting wires, adjustable in altitude, which intercept a base of 500 km. on the ground. The navigator sights a reference point and meas-

ures with a chronograph the time of passage from one wire to the other. An abacus gives the absolute speed in km/hr.

In the Le Prieur cinemograph, the sighting is done with the aid of a slide carrying a stylus which traces a line on a paper moving vertically with a uniform speed. These combined uniform motions give a straight line, the inclination of which is a function of the altitude and of the speed. The errors due to changes in the trim of the aircraft are eliminated by the fact of the graphic inscription.

In the navigraph, the absolute speed is obtained by the automatic production of the triangle of velocities, of which the sides "air speed" and "wind" are known, as also the angle of drift.

Observation point.—This can be obtained by watching the ground. The navigator either identifies some reference point under him or determines his position with the aid of distant reference points.

When the ground is not visible, the observation point is found by observing the stars, according to methods similar to those employed at sea. Unfortunately, the mariner's sextant is not utilizable on aircraft and no other instrument has thus far afforded any practical solution of the problem. For want of an astronomical point, the aerial navigator can utilize radiogoniometry.

The preceding exposition shows that loxodromy is the basis of aerial navigation. The ideal map for aerial navigation is therefore the one on which all the loxodromes are represented by straight lines and their angles with the meridians. Only Mercator's projection will answer these requirements. Its use for general aeronautic maps is therefore fully justified.

As regards utilizable routes in aerial navigation, we have purposely omitted orthodromy (sailing on the arc of a great circle). The arc of a great circle is in fact the shortest way between any two points on the earth's surface and would therefore seem preferable to loxodromy. This advantage is, however, only theoretical, since for all points less than 1,000 km. (622 miles) the difference between the orthodrome and loxodrome is negligible (about $1/300$). Now, the stops, the obligatory points for crossing frontiers, and natural obstacles impose an itinerary, whose sections rarely attain 1,000 km. These sections are therefore loxodromes.

There remains the employment of orthodromy on very long trips. Here again flight on the arc of a great circle does not make good its promises. If the points of departure and arrival are on the same parallel of latitude, the vertex or culminating point of the curve is near the pole and hence climatic considerations prevent the utilization of the most important part of the ideal curve. If the points of departure and arrival are almost on the same meridian or near the equator, the orthodrome and loxodrome differ but little. It should be noted, moreover, that the only method for describing a great circle consists in resolving it into a series of successive loxodromes of about 1,000 km. which are followed by means of a compass.

The arc of a great circle therefore serves to determine an itinerary. There is no need of special maps for this purpose, since Mr. Favé, a member of the Institute, has invented a rapid and simple method of tracing the arc of a great circle on a Mercator map. The employment of the Favé abacus enables the aerial navigator to determine instantly and accurately the points through which an arc of a great circle passes by simply moving over the map a transparent sheet on which is traced a whole series of curves representing the projection of various great circles whose vertices are on any given meridian.

In conclusion, we may say that, on the one hand, the question of aeronautic maps is progressive and is following its normal course; while, on the other hand, the empirical methods of aerial navigation thus far employed are retrogressive, slow and dangerous and should be replaced by scientific methods of navigation, based on loxodromy and the use of the compass.

(Translated by the National Advisory Committee for Aeronautics.)

STANDARDIZATION AND AERODYNAMICS

By DR. TRIZ. RICHARD KATZMAYR

Aerodynamical Laboratory of the Technischen Hochschule of Wien, Austria

WITH reference to the suggestion made by W. Knight in the AERIAL AGE, of June 20, 1921, for calling a congress of representatives of aeronautical laboratories in Europe and in the United States in order to arrive at an international agreement on the subject of wind-tunnel experimental work and standardization of aerodynamical terms and symbols used in aeronautical technical works, I wish to express my point of view of both Prof. Triz. Richard Knoller and myself on this subject.

After the very interesting discussion in the AERIAL AGE, by Prof. Prandtl (Oct. 3, 1921), by Prof. Karman (Jan. 2d, 1922), by Col. Costanz, (Feb. 20th, 1922), by Mr. Margoulis (March 6th, 1922), and by Col. Verdugio (April 3d, 1922) of Mr. Knight's article on "Standardization and Aerodynamics", I think it is well to state the stand taken on this matter by our laboratory.

In the issue of AERIAL AGE, which appeared on October 3d, 1921, Prof. L. Prandtl insisted on the absolute necessity of

having an airstream of great constancy and freedom from eddies if wind-tunnel experiments are to have any practical value, and showed how such an ideal airstream can be obtained in practice. As a matter of fact the wind-tunnel of the Aerodynamic Institute, at Göttingen happens to be one of the few that permit such excellent conditions, and it should not be difficult to build all future wind-tunnel installations to give equally good results, if Prof. Prandtl's carefully-prepared specifications be closely adhered to. In the great majority of existing laboratories the airstreams that can be obtained with present apparatus are all but even, yet it would be uneconomical and too radical to consign them to the scrap-heap forthwith for that reason.

It would be of great value, however, if it were possible to compare without further question results obtained upon similar models in different laboratories, and this is quite within present possibilities. It would only require the testing of a number of standard bodies (such as spheres, fusiforms and one or two aerofoils), for their aerodynamic characteristics in all the leading laboratories and to compare results. To insure accuracy and to prevent slight differences in the models that might affect their behavior under test, the same set of models should be used in each experiment, no matter where performed. The several results thus obtained could then be used to establish what we might call a "laboratory factor" or a constant which would express all those elements which are peculiar to the laboratory in question and which cannot be deduced mathematically, as turbulence, proportion of model to area of airstream and especially the influence of the means for fastening the model to the balance. It is not sufficient to test merely a sphere, as was suggested, as such investigations as have been made with wing models have given different results. At the present time a series of comparative tests is being made between the laboratories in Vienna and Göttingen and it is intended to send the models to all the other wind-tunnels in Germany to obtain a better basis for comparison. It would be advisable to have this matter taken up by an international committee so as to include all the leading European and American institutions.

Attention should be called to the fact that for practical purposes it is not always advisable to employ a current that is totally free from eddies, such a condition is never prevailing in free flight. The degree of turbulence in the Vienna wind-tunnel happens to be such that the results therein obtained can be adopted without further correction, and several comparisons of full-sized machines with their models (usually in 1:15 ratio) have shown a remarkable correlation of the actual flight performance with the results calculated from wind-tunnel tests. It was noticed that an increase in tur-

bulence has the same effect as the increasing of $\frac{v_i}{v}$, which

fact is of importance to laboratories of small dimensions and comparatively slow air-speeds, which are thus enabled to give satisfactory results with lower cost of construction and maintenance. For purely theoretical measurements, however, an airstream without turbulence is essential.

Regarding the size of the models and the best airspeed to be used, it may be observed that the results obtained during the past 10 years in the Vienna laboratory with a standard aerofoil of 900 x 150 mm. and in an airstream of 18 meters per sec. have proven very satisfactory.

Of great importance is the correct fastening of the models in the airstream. They should be so secured that the flow around the model is not disturbed, and yet a very stiff and inflexible mounting is essential. At Vienna this is obtained by means of four wires and a stream-lined supporting rod 2.5 millimeters thick.

In AERIAL AGE, of October 3d, Prof. Prandtl commented upon the advantages of reducing the airspeed to the equivalent expression for height ($\frac{V^2}{2g}$) as first proposed in 1914

by Prof. Knoller and adopted by all German laboratories since 1917. He also advocated the general introduction of absolute coefficients.

One of the most necessary tasks of such an international committee is the standardization of aerodynamic definitions and units. Without prejudice toward the labor of the future committee the most widely used expressions and their generally accepted meaning may be summarized here.

In Austria the following symbols have been decided upon:

$p = \frac{V^2}{2} g$ = Velocity pressure, dynamic air pressure, head.

v = resultant velocity, flight speed in meters per second or feet per second.

V = the same in KM per hour or M. per hour.

F = Wing surface or wing area.

R = Resistance.

A = Lift.

W = Drift.

N = Normal force.

T = Tangent force.

C_R, C_A, C_W = Unit air resistance, unit lift, unit drift, or absolute coefficient of res., lift or drift.

e = Center of pressure.

$M = Ne = \text{Torque.}$

$E = \text{Ratio } \frac{W}{A}$

X = Angle of incidence.

The following is an exposition of the choice of the above symbols:

p stands for "velocity pressure", and is well nigh international (pressure in English, pression in French, pressung in German) being derived from the common Latin root *premo* (to push).

v and V for "velocity," derived from the Latin "velocitas." F for surface, with reference to the English and French (sur)face and the German fläche, all of which are derived from "facies".

R was chosen for "resistance", a word identical in most languages; also stands for the German "resultierende" (resultant).

Hitherto R was resolved into its components L (lift) and D (drift), corresponding to the French R_y and R_x and the German A and W , the assumption being that L is perpendicular and D parallel to the line of flight. To speak about "lift" in this sense, however, is not strictly correct, inasmuch as a strict interpretation of that word assumes a force that is vertical with respect to the horizon and is equal and opposite to gravity, which condition in actual flight is but seldom true. It would therefore be advisable to use another symbol in every language. Prof. Knoller proposes to replace "lift" by "shear"—as expressing more correctly the action of a force which is perpendicular to another force independently of the latter's direction in space. The word "shear" being an engineering term meaning a force acting perpendicularly to the grain of a given material (German for shear = "schubkraft"). S would be a better symbol in spite of the fact that the corresponding French word is "cisaillement."

The present symbol for drift or drag could be retained, and the present German expression (rücktrieb) could be replaced by "druck", meaning to pull or pressure, and a mathematically more correct expression. D therefore fits all languages and should be retained. Another proposal made by the present writer would substitute Z and X for L and D . The advantage thereof lies in the internationally understood application and the fact that the resistance R is actually resolved into two components which are vertical only to each other and belong to a system of coordinates of which the X axis is parallel to the line of flight. The aerodynamic expert is already familiar with the practice of referring moments of stability to this system, the axes being assumed to be identical with the theoretical axes of the machine itself.

The symbols N for normal force and T for tangent force are internationally self evident and require no explanation.

As Mr. Knight has observed, the greatest difficulty is encountered with the expressions C_R, C_A, C_W . In Germany and Austria they stand for dimensionless or "absolute" coefficients, which are obtained by dividing the forces R, A, W by the area F and the pressure p , as given by the equation $R = C_R F p, A = C_A F p$, and $W = C_W F p$. To express these quantities as "unit forces" is better, it being generally easier to understand a mathematical formula when every factor stands for a definite and concrete entity rather than a purely philosophic concept. After all C_R, C_A, C_W are "forces" in the accepted sense, for they express a weight in kilograms which would act on a one square meter of surface under a dynamic pressure of 1 millimeter hydrostatic pressure. To write with a small (C) immediately conveys the impression that a coefficient is expressed, and writing it before the symbol prevents misunderstanding with exponents. This method of writing instantly indicates what force the coefficient refers to and is therefore easier to read than either the English (k_L, k_D) the French (k_x, k_y) or the German (C_A, C_W) in all of which the stress is laid on the quantity as a "coefficient" and the force that it refers to is merely indicated by a small letter below. To avoid every mistake it should be noted that

$$C_A = 200 k_L = 1600 k_y = C_A$$

In addition in Austria the following symbols have been accepted: sA for "specific lift" as per the expression $A = ^sA p$ and rA for "reduced lift" as per the formula $A = ^rA F$. These expressions have been found very useful. Of course the prefixes s and r have international significance in this respect.

(Concluded on page 206)

THE BACKGROUND OF DETONATION

By STANWOOD W. SPARROW

A DETERMINATION of the relative merits of various fuels for use in high compression engines is the object of experiments being conducted at the Bureau of Standards for the National Advisory Committee of Aeronautics. Inasmuch as the tendency of a fuel to detonate often makes it unsuitable for such use, a consideration of the general subject of detonation has formed the initial step in this investigation. The purpose of this note is not to summarize the available information on the subject but to discuss a phase which seems to have received relatively little attention.

In most discussions of detonation attention has been focused on the rate or the nature of the combustion. Charge temperatures and pressures before combustion have been considered from the standpoint of their influence on this rate rather than from the standpoint of their influence on the temperatures and pressures after combustion. This does not imply that investigators have failed to appreciate this latter influence, but that they have thought of it as a sort of necessary background fixed by the compression ratio and so have turned their attention to a factor that could be altered, namely, the rate of combustion. It is believed, however, that a careful scrutiny of this "background" will throw considerable light on some of the results that have been obtained in detonation research and to this end the following discussion is devoted.

Fig. 1, which presents results obtained from a one-cylinder engine, forms a convenient starting point. In this figure and throughout the paper, the presence or absence of detonation should be understood to mean the presence or absence of the metallic ringing sound characteristic of detonation.*

As indicated in the figure, detonation was only apparent at spark advances between 25° and 55° before center. More interesting is the fact that with this engine detonation only occurred when the explosion pressure as measured was somewhat greater than 450 pounds per square inch. From this, one would conclude that for a given engine the explosion pressure must exceed a definite value if detonation is to result. Such a conclusion is a natural consequence of the common belief that the sound which serves to identify detonation arises from a deflection or vibration of the combustion chamber walls. It seems logical, therefore, to consider such changes of engine condition as are known to affect detonation and to estimate the effect of such changes upon the explosion pressures.

Compression ratio deserves first attention as it is known to exert great influence upon the tendency of an engine to detonate. Accordingly, calculated explosion pressures for several compression ratios have been plotted in Fig. 2. These have been computed as though the entire charge were burned at top center with no heat loss. Obviously explosion pressures thus calculated should exceed those obtained in practice.

Nevertheless they form a satisfactory basis for comparison, provided actual rates of burning and heat dissipation are approximately the same for all the conditions compared. Moreover, ground for believing that this assumption is not far from the truth comes from the testimony of numerous investigators that they have obtained maximum power with nearly the same spark advances over a wide range of fuels* and compression ratios.

In calculating the values for Fig. 2, the following familiar relations have been employed:

$$P_2 = P_1 r^n$$

$$T_2 = T_1 r^{n-1}$$

$$M = T_3 - T_2$$

$$P_3 = P_2 \left(\frac{T_2 + M}{T_2} \right) = P_2 \left(1 + \frac{M}{T_2} \right)$$

where

r = ratio of compression and expansion.

P_1 = absolute pressure at beginning of compression stroke.

T_1 = absolute temperature at beginning of compression stroke.

P_2 = absolute pressure at end of compression stroke.

T_2 = absolute temperature at end of compression stroke.

M = increase in mixture temperature due to combustion.

T_3 = absolute temperature after combustion.

P_3 = absolute pressure after combustion.

n = exponent having experimental values ranging from 1.25 to 1.35.

In preparing Fig. 2, P_1 has been taken as 14.7 pounds per square inch, M as 2700°C and n as 1.3. In figuring T_1 , the fresh charge has been assumed equal to the piston displacement in volume when at atmospheric pressure and at an absolute temperature of 320°C. In like manner the residual products of combustion have been assumed of a volume equal to the engine's clearance space when at atmospheric pressure and at an absolute temperature of 1273°C.** Some values thus calculated are tabulated below:

r	T_1	T_2	P_2	P_3	T_3
4	393°C	595°C	89	494	3295°C
5	376	610	119	645	3310
6	365	625	151	806	3325
7	358	643	185	960	3343
8	353	660	219	1115	3360

* All fuels give nearly the same maximum power at the same compression ratio.

** It should be remembered that the aim is a comparison rather than accurate determination of temperature and pressures. This justifies the omission of steps that otherwise would be essential. For example, the temperature increase produced by combustion has been taken as 2700°C for all compression ratios, although because of the smaller clearance volume of spent gas the amount of temperature rise should increase with the ratio (since less of the energy of combustion is expended in raising the temperature of the inert gas). An opposing tendency is the increase in specific heat that results from the higher compression temperatures of the higher compression ratios. The use of the same value of exhaust gas temperature for all ratios is open to similar

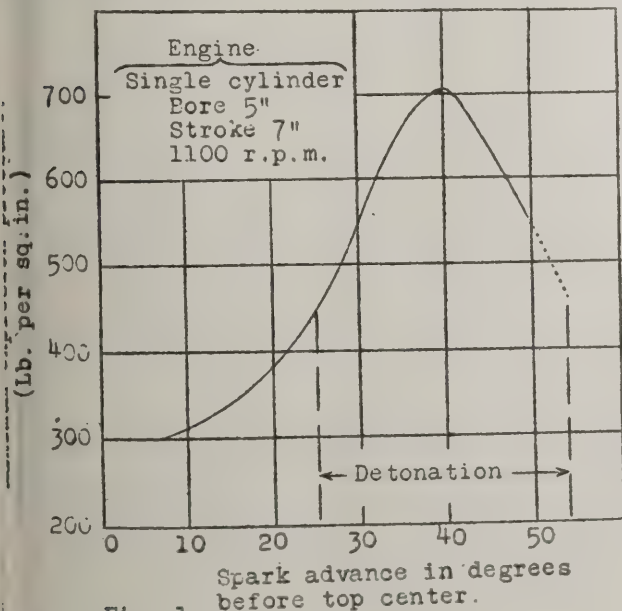


Fig. 1.

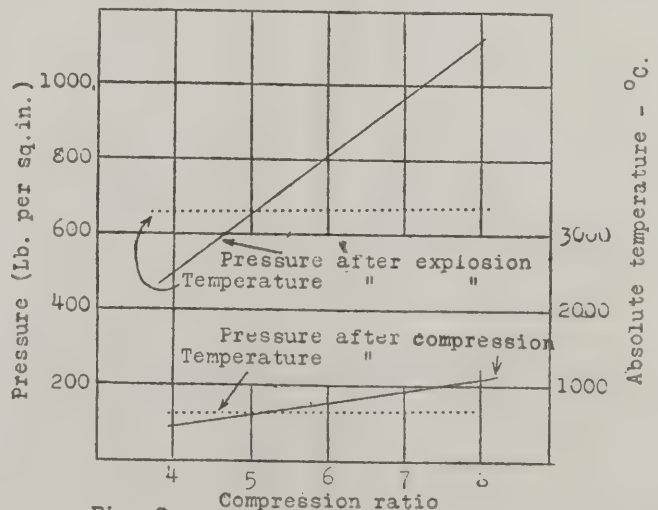


Fig. 2

* For a discussion of quantitative methods of measuring detonation, see "Methods of Measuring Detonation in Engines," by Thomas Midgley, Jr., and T. A. Boyd. Journal of the Society of Automotive Engineers, January, 1922.

criticism. An increase in expansion ratio tends to lower this temperature, which effect is opposed by a decrease in heat loss due to the decrease in combustion chamber surface. These various tendencies have been considered but are not included in the calculations as their combined influence should affect the comparative values less than 5%.

Attention has been directed repeatedly to the many tendencies toward an increase in combustion rate with an increase in compression ratio. A smaller volume through which the flame must spread and a smaller proportion of inert gas are two of the factors emphasized. All such tendencies would increase the differences shown in Fig 2. The significant thing is that, neglecting all such possibilities, assuming no change in combustion rate, there would still be an increase in explosion pressure of over 125% produced by changing from a ratio of 4 to one of 8. This change in ratio would only increase the absolute temperature at the end of compression by 11% and the absolute temperature at the end of combustion by 2%. One is not surprised, therefore, that a well known British investigator concludes charge temperature to be of minor importance from a detonation standpoint.*

At this point it is well to consider Fig. 3, which presents some of the most interesting information that this investigator, Mr. Ricardo, has obtained from his variable compression engine. The figure shows data obtained by throttling the engine, at compression ratios above 4.8, to the point of detonation. The dotted line shows the I. M. E. P. obtained at full throttle with a non-detonating fuel. After operating at each ratio the compression pressure was measured with a gauge while the engine was driven by a motor at the same speed and throttle opening as before. The most striking lesson from this curve is that detonation occurs at very nearly the same compression pressure regardless of the compression ratio.

Inasmuch as this discussion is concerned with the relation of explosion pressures to detonation, an estimate of the probable explosion pressures for the conditions shown in this figure is in order. One might anticipate that the expansion of the gases after passing the throttle would cause an appreciable temperature drop. Calculation and experiment both show this effect to be negligible under the circumstances under consideration.* Another factor which is likely to influence the temperature at the beginning of compression is the proportion of exhaust gas present. This can be estimated rather closely by assuming that the weight of fresh charge at part throttle bears the same relation to the weight of charge at full throttle as the I. M. E. P. at part throttle bears to the I. M. E. P. obtained at full throttle with a non-detonating fuel.

* Harry R. Ricardo, "Transactions of the January, 1922, Meeting of the Society of Automotive Engineers." The conclusion quoted is expressed thus, "Our experiments appeared to show pretty clearly that detonation has very little connection with the temperature of compression, but is closely dependent upon the compression pressure."

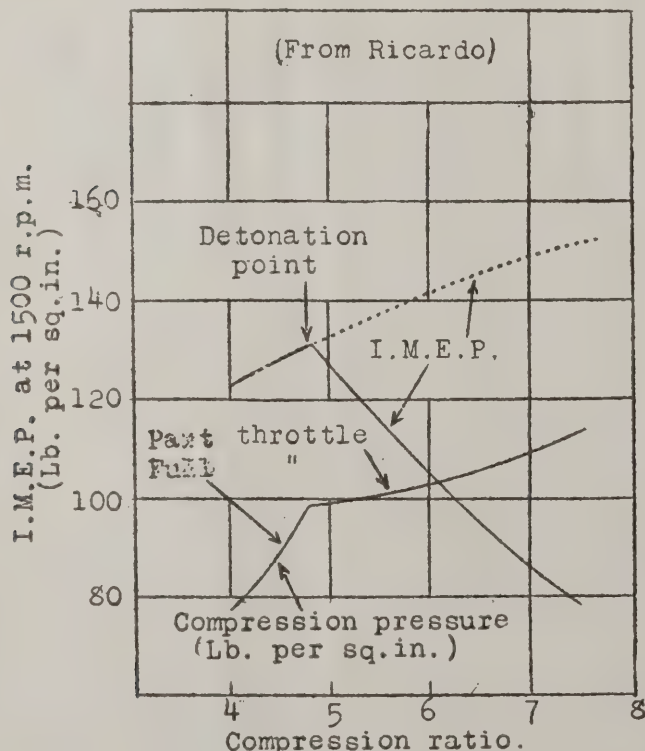


Fig. 3.

Actual experimental determinations of I. M. E. P. are given in the figure. Except for the use of the I. M. E. P. to estimate part throttle exhaust gas content, the method of calculation is the same as that used in obtaining Fig. 2. Although throttling an engine of fixed compression ratio tends to increase the proportion of exhaust gas to fresh charge, the calculations indicate that with the variable compression engine under the circumstances under discussion there is an accompanying decrease in clearance volume which neutralizes this effect. Thus over the range covered by the curves the exhaust gas expressed as a percentage of new charge varies less than 1. It follows that the temperature at the beginning of compression will remain nearly constant and values calculated on this basis are tabulated below:

r	T ₁	T ₂	T ₃
4.8	388°C	620°C	3320°C
5.0	388	629	3329
5.5	388	648	3348
6.0	388	664	3364
6.5	388	680	3380
7.0	388	696	3396
7.5	388	710	3410

It will be recalled that the relation between explosion pressure and compression pressure is as follows: $\frac{P_3}{P_2} = 1 + \frac{M}{T_1}$

An increase in compression ratio means an increase in T₂ and hence a decrease in the value of this ratio. For this reason a higher explosion pressure will be obtained from a low compression ratio engine at full throttle than from a high compression ratio engine throttled to the full load compression pressure of the low ratio. This fact may be stated from a slightly different angle in this fashion—to maintain a constant explosion pressure the compression pressure should increase slightly with increase in compression ratio.

* On p. 109, of Bulletin No. 19, of the Engineering Experiment Station of Ohio State University, Prof. Norman discusses the laws governing this drop in temperature and calculates the following values:

Gas velocity in feet per second	50	100	200	300
Temperature drop in degrees C	0.1	0.4	1.8	4.2

Tests at the Bureau of Standards showed no decrease in manifold temperature when the throttle of an aviation engine was closed while it was being motored with the fuel supply cut off.

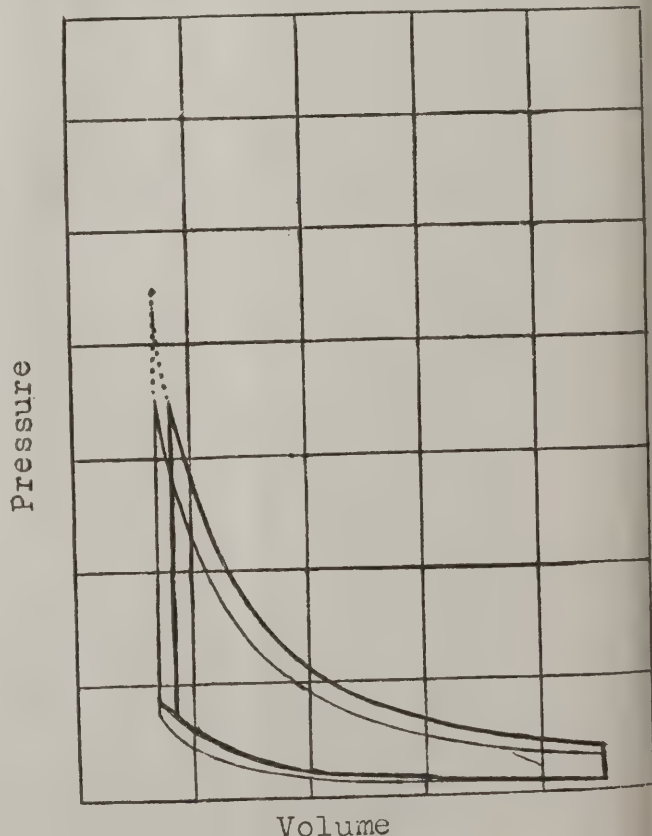


Fig. 4.

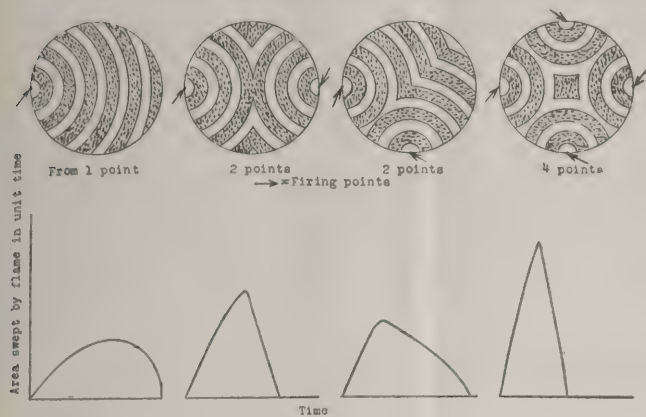


Fig. 5.

Explosion pressures as calculated for Fig. 3 are tabulated below:

r	P ₂ (Absolute Pressure)	P ₃
4.8	113	606
5.0	113.2	599
5.5	114.2	589
6.0	116.2	589
6.5	119.2	592
7.0	123.2	601
7.5	127.7	612

The maximum variation in explosion pressures is seen to be less than 4% and the deviation from the average pressure about 2%. When experiment has shown detonation to be constant under the conditions of Fig. 3, and calculations show explosion pressures to have been constant, there is reason for a deepening conviction in the close relationship of explosion pressures to detonation.*

Scavenging, that is to say, removing all or part of the spent gases from the clearance space, increases detonation. This fact has been taken as convincing proof of the great influence exerted by small proportions of exhaust gas on the rate of flame spread. Very probably this influence exists and operates as supposed. It is true, nevertheless, that the effect of scavenging on detonation can be explained partially at least by its influence on the explosion pressure. This influence is twofold. First of all, removing the hot exhaust gases from the clearance space of the engine means a lower temperature at the beginning and hence at the end of compression.

Reverting again to the relation $\frac{P_3}{P_2} = 1 + \frac{M}{T_2}$, it is

clear that lowering T_2 , increases the ratio and thus the explosion pressure. This holds true if M , the increase in temperature resulting from combustion, does not decrease. But M should increase since the energy of the fuel is expended in heating a smaller mass of inert gas. This then is the second tendency toward increased explosion pressure and consequently detonation. Calculated explosion pressures show a probable increase of over 25% for a scavenged in comparison with an unscavenged engine having a compression ratio of 4.

Another influence which vitally affects detonation is the ignition timing, the spark advance. As before, it is convenient to picture the charge burned at constant volume at a point in the stroke governed by the spark advance. This does not mean picturing the combustion as occurring at the same time as the spark but as always occurring at the same interval of time after the spark. The burning that takes place during this interval may be treated as the burning of a fuse that later fires the explosive. As shown when discussing the effect of compression ratio, the maximum explosion pressure should occur when the pressure prior to combustion is greatest. Since the charge is compressed most at top center the maximum explosion pressure should result from a spark so timed as to cause the actual combustion to take place at that part of the stroke and retarding the spark so that combustion comes later

should decrease the explosion pressure. For the engine from which the pressure measurements of Fig. 1 were taken the estimated ratio of the explosion pressures obtained with combustion at various angles past top center to what would have resulted from combustion at top center are given below.

Degrees of crank angle after top center at which equivalent instantaneous combustion occurs.

Explosion pressure in % of the pressure when equivalent instantaneous combustion occurs at top center.

0	100
10	94
20	84
30	72
40	59
50	49

This demonstrates that very considerable differences in explosion pressure would be expected from a change in spark advance even if the rate of combustion remained the same. When there is superimposed the influence of a change in rate, it is not surprising to find differences of the magnitude shown in Fig. 1. The pressure at the time of explosion should be the same whether combustion takes place at a given angle before top center or after. With combustion before center, however, barring the heat loss, the subsequent compression of the burned gases will increase the pressure to a value in excess of that resulting from burning the charge at center. In practice it often happens that with an early spark the rate of heat loss exceeds the rate at which heat is produced by the compression of the burned charge so that the maximum pressure of the cycle is lower than with a less early spark. This accounts for the decreased pressures at the extreme spark advances of Fig. 1. Furthermore, it is not surprising that carbon-bisulphide, which preignites early in the stroke, does not detonate since the effect of preignition is that of a too early spark.*

The relative influence of spark advance and throttle opening on detonation is of considerable importance in connection with the use of high compression over-dimensioned engines. Such engines have too high a compression ratio to operate safely at sea level at full throttle with the spark advance that would give maximum power with a non-detonating fuel. Experiments at the Bureau have shown that for an emergency "take-off" such engines will develop more power if the spark is retarded to eliminate detonation than if the throttle is closed to produce the same effect.

Aside from its practical bearing on engine design, it is worth while to see whether the comparative influence of spark advance and throttle opening would be predicted from their influence on explosion pressures. The theoretical indicator cards of Fig. 4 will aid the comparison. In this figure the dotted line indicates the pressures at full throttle with a non-detonating fuel and a compression ratio of 6.5. The problem is to obtain from this engine the maximum power that is possible with a fuel which because of detonation cannot be used with an unthrottled engine having a compression ratio in excess of 5.5 (the volumetric efficiency is assumed the same for both ratios). If explosion pressure controls detonation, the problem resolves itself into so adjusting spark advance or throttle as to restrict the explosion pressure to the value obtained with an unthrottled engine of 5.5 ratio. Since the explosion pressure with a 5.5 ratio is about 82% of that with a 6.5 ratio, an engine having the latter ratio must be throttled to about 82% of full load. (Taking into consideration the modifying factors discussed in connection with Fig. 3, gives 85% as a closer value.) The full curve of the figure shows the probable pressure under this throttled condition.

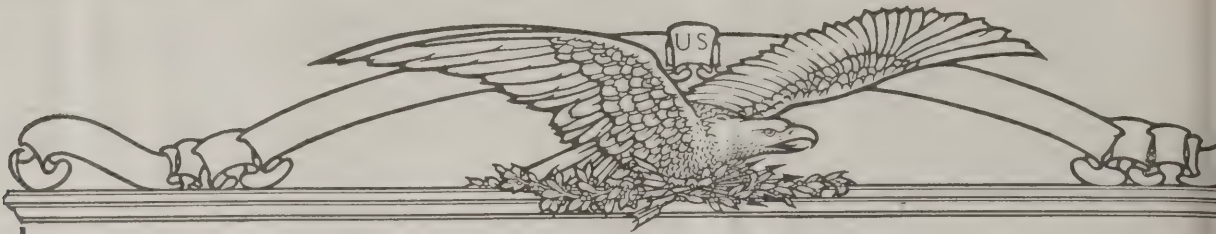
The other alternative is to retard the spark so that combustion does not take place until the piston has traveled far enough on the down stroke for the pressure to have fallen to the maximum compression pressure with the 5.5 ratio. A full heavy line shows the pressures under this condition. Since the engine receives a full weight of charge, the power should be less than that obtained with the non-detonating fuel only because the ratio of expansion after combustion is 5.5 in contrast with 6.5 with the non-detonating fuel and the optimum spark advance. The air cycle efficiency** for a 5.5 ratio is 94% of that for a 6.5 ratio. Thus retarding the spark to

* On page 6 of "Recent Internal Combustion Engine Research," presented at the January, 1922, meeting of the Society of Automotive Engineers, Mr. Ricardo says: "... the tendency to detonate depends in effect upon the compression pressure not, as I supposed, because the pressure has any marked influence, but rather because in any actual engine the compression pressure is in itself a measure of the proportion of inert diluent present in the cylinder."

The reader will perceive that the author's interpretation of the data is somewhat at variance with Mr. Ricardo's. It is regrettable that the scope of the paper does not permit citing the many views of Mr. Ricardo with which he is in hearty accord. The use of Fig. 3 is but one indication of his belief in the accuracy and value of Mr. Ricardo's experimental determinations.

* In the Journal of the Society of Automotive Engineers, September, 1920, C. F. Kettering says: "Using carbon-bisulphide as a fuel, we get a genuine preignition. This fuel ignites very early and the pressure rises rapidly but it will not knock. Preignition will not necessarily cause a knock, because it may be that the pressures will not rise higher than normal."

** Air cycle efficiency = $1 - \frac{1}{r^n}$ where $n = 1.4$ and $r =$ expansion ratio.



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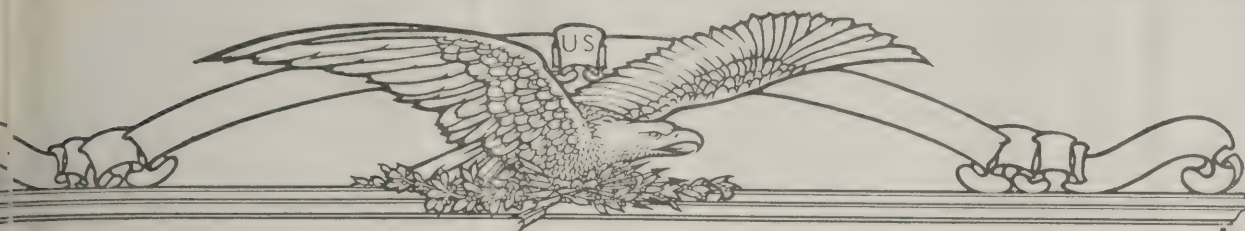


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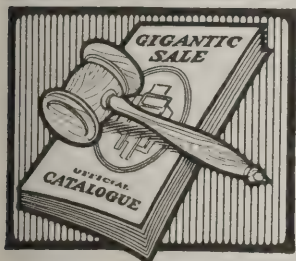
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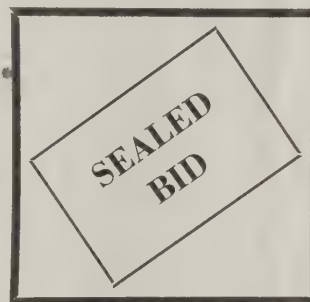


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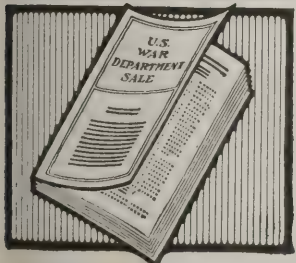
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ARTMENT

(Continued from page 203)

avoid detonation requires a 6% decrease in power against the 15% sacrifice which throttling entails.

From all the evidence presented it appears that a close relationship exists between explosion pressures and detonation and that, having calculated the explosion pressures for an engine condition at which detonation occurs, for any other engine condition the probable presence or absence of detonation can be predicted from a calculation of the probable explosion pressure. It does not follow necessarily that the uniform explosion pressures as here calculated produce the sound of detonation. There is evidence that there are local pressures which exceed these average pressures and to which should be charged both the sound and destructive effects of detonation. The evidence does indicate that if local high pressures exist they are proportional to the average pressures as calculated, inasmuch as the latter have proved an accurate index of the presence or absence of detonation.

Emphasis, thus far, has been placed on conditions that influence detonations even with the rate of combustion unchanged. Better appreciated and no less important is the influence of a change in combustion rate with other conditions remaining constant. In fact, detonation research has confined itself largely to attempts to influence this rate. The goal is a slowing down of the final stages of combustion. It may be neither necessary nor desirable to decrease the average combustion rate. Tradition tells us that it was the "last straw" that brought disaster to the back of a camel and similarly, it is the last rise in pressure that brings ruin to the head of a piston. An illustration will show how this disastrous peak pressure may be avoided by a slight change in the combustion rate. For the first condition assume that the piston is at top center, that all the charge has been burned and that the charge temperature is 3350°C. Assume also that a temperature drop of 250°C results from the heat dissipation during the next 10° of crank motion. For the second condition let it be assumed that when the piston reaches top center sufficient charge has been burned to have produced a temperature of (3350—250)°C and that the remainder is burned during the next ten degrees of crank motion at such a rate that the heat input shall just offset the heat dissipation and the pressure and temperature at 10° past top center be approximately the same as in the first case. The ratio of the pres-

$$\frac{3350 - 250}{3350}$$

sure in the latter case to that in the former is

$$\frac{3350}{3350 - 250}$$

or 93%. The only difference in power that should result is that due to a loss in efficiency chargeable to the decreased expansion ratio of the portion of the charge burned in the ten degrees after center. Calculation shows the net loss to be less than two-tenths of one percent. In short, a decrease of 7% in maximum pressure is obtained at the expense of a decrease of two-tenths of one percent in power.

Fig. 5 indicates in a general way why differences in spark plug position and combustion chamber shape change the rate at which the charge is consumed. By means of the alternate light and dark areas the amount of surface swept by the flame from each spark plug in equal time intervals can be determined. The lower plots show total areas swept by flame in unit time plotted against time. In these figures the

area under the curve at the left of any ordinate represents the total area swept by the flame up to that time. The upper flame spread diagrams are drawn as though the flame moved radially at a uniform linear rate. This assumption is admittedly false for the flame, at least in its initial stages, spreads at an accelerated rate. Moreover, in the engine it is not areas with which one is concerned but volumes and the problem is further complicated by the movement of one wall of the combustion chamber, namely, the piston head. Obviously, then there is no point in analyzing the figures to show which spark plug arrangement gives minimum detonation. Their sole aim is to show why a change in spark plug arrangement should make a difference in detonation.*

A discussion of the influence of changes in fuel characteristics upon detonation lies outside the province of this paper. Possibly the most hope of relief from detonation troubles lies in the ability to alter these characteristics, and much excellent work has been done in this field.**

Except in the case of the automobile engine the noise of detonation in itself is of no consequence. Detonation's seriousness lies in its high pressures and in the excessive heat loss which prevents the attainment of the power that would otherwise be possible. Most investigators have been made acquainted with this excessive heat dissipation by an increased loss to the jacket water whenever detonation has been present. In a preceding paragraph a comparison was made between the effect of burning all the charge at top center with a resultant temperature of 3350° C. and slightly retarding the rate of burning so that the maximum temperature did not exceed 3100° C. Radiation varies approximately as the fourth power of the absolute temperature and would at top center be 35% greater with the higher temperature. It seems clear that much of the power loss that accompanies detonation can be attributed to excessive heat dissipation arising from a condition approximating the one just mentioned.

Preignition and detonation are now generally conceded to be entirely independent phenomena. Preignition is unusual, caused by a hot spark plug electrode, by an exhaust valve or by a piston head and depends upon the ignition temperature of the fuel. Changes in the design of these members will do much to prevent this trouble. The important fact is that such changes will be necessary with an increase in compression ratio unless the fuel has been prepared to eliminate preignition as well as detonation. It may be mentioned in passing that overheating troubles are a more likely result of preignition than of detonation. This can be illustrated best by assuming an extreme case of preignition with the charge ignited as it enters the cylinder and all burned by the beginning of the compression stroke. It is conceivable that the rate of heat dissipation during this stroke should be such that at top center the same pressure and temperature would result as when, under normal operation, the bulk of the charge is burned at top center. Pressures and temperatures during expansion would be the same for both cases. For the compression stroke, however, the average temperature with preignition would have been in the neighborhood of 3000° C. in contrast with 500° C. under normal operation.

As stated in the outset, this paper's aim has not been to present a complete picture of detonation but to consider several more or less independent features of the problem which have received comparatively little attention. Whether these features belong in the background or foreground is immaterial so long as they are recognized as an essential part of the picture.

* For a discussion of actual combustion chamber shapes and their influence upon detonation, see "Turbulence," by H. L. Horning, on page 579 of the Journal of the Society of Automotive Engineers, June, 1921.

** "Combustion of Fuels in Internal Combustion Engines," by C. F. Kettering, Journal of the Society of Automotive Engineers, September, 1920; "Combustion of Fuels in Internal Combustion Engines," by Thomas Midgley, Jr., Journal of the Society of Automotive Engineers, December, 1920.

(Concluded from page 200)

The symbol e to indicate the distance of the center of pressure from the upper aerofoil surface has been in use in Germany and Austria for over ten years with good results. In other countries this quantity is seldom made use of. Whether e is the best symbol for this expression is a matter that should be decided by the committee.

M as an expression for torque is a well known symbol in mechanics, and it is advisable to retain it for that reason. Mathematically $M = N \times e$ and since N is nearly equal to A the expression $M = A \times e$ can be safely used for approximations. In Austria the special symbol $^aM = A \times e$ has been adopted.

Just as we have units of force we can have a "unit of torque"—also an abstract coefficient. For its expression cM has been devised with its corollary cM . We can, therefore, write

$$M = ^cM \times F \times p \times t \text{ and } ^aM = ^cM \times F \times p \times t$$

in which "t" is the chord.

Σ expresses in Germany the ratio $\frac{W}{A}$ and χ the angle of

incidence. Whether these symbols should be internationalized is fit subject for discussion.

Regarding the graphic representation of test results it may be observed that the Vienna laboratory conforms itself to the standards prevalent throughout Germany.

It would be very desirable to come to some international agreement regarding the unification and standardization of aerodynamical expressions, and we hope that Mr. Knight will succeed in eliminating such objections as still, perhaps, exist toward the satisfactory solution of this important matter.

Translator's Note—In his paper Dr. Katzmay speaks of Σ as indicating $\frac{W}{A}$, that is $\frac{\text{drift}}{\text{lift}}$. I have retained this expression in the translation in spite of the apparent error. In Germany the lift drift relation is expressed as a fraction. Here is a matter which surely calls for standardization.

I cannot agree with the author that "shear" would be preferable to "lift". There is nothing in the latter word that presupposes (as he states) a direction opposed to gravity and a lifting force might easily be conceived acting at an angle to the absolute vertical. In an aeroplane "lift" resolves itself into a "shear" at wing hinges where the latter are fastened to the fuselage, but that is a mechanical condition which is no factor in wind-tunnel work.



NAVAL *and* MILITARY AERONAUTICS



New Airship Class at Langley Field

Due to the fact that the last Airship class at Langley Field, Va., was nearly wiped out as a result of the Roma tragedy, the next class is being pushed forward, and it is now expected that it will commence operations on April 24th. This class will be composed of ten officers. Every effort is being made to supply the present efficiency of airship pilots so that the tactical development of airships may be proceeded with.

The Fastest Airship in the United States

The loss of the "Roma" created quite a void in the big lighter-than-air hangar at Langley Field, Va., and, to compensate for the loss of the giant dirigible, an English "Mullion" type airship was inflated about three weeks ago and has since been operated quite extensively. It is being used for the training of cadets in the piloting of two-man control airships.

The "Mullion" type airship was developed by the British in 1918 for use as a short range coastal patrol ship. It is fitted with two 75 h. p. Rolls-Royce "Hawk" engines, mounted above the stem of a streamlined car and driving pusher screws. The envelope has a capacity of 30,000 cubic feet of buoyant gas, and measures 165 feet in length, 49 feet in height and 35 feet, 6 inches in diameter. While the theoretical full cruising speed is 57.5 miles per hour, the airship officers who have flown this ship at Langley Field state that it is the fastest airship in the United States today. On several occasions it is claimed that a speed in excess of 61 miles per hour has been achieved.

This ship is very trim and neat in appearance, and offers considerably less resistance to the wind on account of the construction of suspensions, and the shape of the bag itself. It has the customary balloonets and trims very nicely. It is reported, however, that the directional controls do not function as decisively and promptly as would be desirable. This is no doubt due to the fact that there is no top tail surface. All directional stability is taken care of by a lower tail surface to which the rudder is attached, and this results in a slight amount of rolling. On attitude control this ship behaves excellently and promptly. The car is light and well designed. Four or five passengers can be carried, although she functions better with only four passengers.

Shortly after the Armistice the War Department purchased several of this type airship. The first one was inflated at Langley Field in 1919, but was destroyed when the temporary hangar blew down. Since that time A, C and D type of ships have been operated for experimental purposes, and this is the first time a "Mullion" has been put in the air.

The "Mullion" is also called the "S. S. Scout," which stands for "Submarine Scout," being motored with two engines. This type of airship performed flights of considerable duration for the British navy and were used for locating and bombing of submarines. Quite a few German submarines were destroyed through the agency of this airship.

Flying Cadets Complete Training

The entire class of flying cadets assigned to Mather Field, Mills, Calif., completed their flying training and will receive commissions in the Reserve Corps, viz:

James C. Ayers, Walter A. Archer, John M. Barnes, Donald M. Cornell, Paul M. Conner, Robert J. Clohecy, John R. Rand, Sidney C. DuBose, Clarence A. Gilbert, Lloyd L. Hefling, Clinton E. Herberger, Guy F. Hix, Theodore R. Howe, Max M. Sternberg, Iver Igelsrud, Andrew J. Marincik, Ivo McKinney, John C. McGinn, Leo L. Mellon, Earl C. Pierce, Arthur L. Smith, Donald A. Templeman.

Of this class, Cadets Hefling, Igelsrud and Ayers took the examination for appointment as 2nd Lieutenants, Regular Army, at the Presidio of San Francisco. The results of their examinations have not yet been determined. By their behavior and application during their training they have each proven that they would be the sort of officers needed in the Air Service.

A Lecture on Meteorology

The command at Mather Field, Mills, Calif., was treated to an interesting lecture on forecasting, meteorology, aviation and sundry subjects, delivered by Mr. Thomas R. Reed, of the San Francisco Weather Bureau. Mr. Reed's work in meteorology has been wide and varied. Added to this knowledge is his experience as an aviator with the French and American forces during the war, making him an authority on the subject as applied to flying particularly. His talk was of absorbing interest to his audience, and the information gained will be of great assistance to each flyer.

Fast Time Between Kelly and Ellington Fields

A report from Ellington Field, Houston, Texas, is to the effect that, so far as known, the fastest cross-country flight between Ellington Field and Kelly Field was made by Lieut. R. T. Aldworth in an MB3 on April 1st. The duration of the flight westward was one hour and 23 minutes (151.8 m. p. h.) while the return flight against a somewhat higher wind was made in one hour and fifty minutes (114.5 m. p. h.). The distance between these two stations is 210 miles.

Spads and MB3's at Ellington Field

The 1st Group (Pursuit) at Ellington Field is rapidly being equipped with Spad and MB3 planes. It is planned by the 15th of April to have enough MB3's assigned to the squadrons to equip each officer of the Group with a plane in preparation for the forthcoming annual tactical training operations to be conducted during the latter part of June.

Ready to Tackle Forestry Patrol

In the event Forestry patrol is authorized for this season, there is not a man in the 91st Squadron at Crissy Field who will not be eager for this duty—which, by the way, is not strange, considering their phenomenal ability to make "smokes" disappear. The Squadron's radio department

will be ready. Eight enlisted men, have been enrolled in the Signal Corps Radio School being conducted at the Presidio, where they will receive a thorough course in operation and maintenance of radio. Two experienced radio operators are now on duty with the Post Radio Department, and the ships of the 91st are rapidly being equipped with newly overhauled equipment. The pilots and observers are receiving practical instruction by being required to work with the home station while on flights.

A New Hospital Aeroplane

The JN6HG aeroplane, which was remodeled at the Fairfield, O., Air Intermediate Depot into a hospital ship, has been completed and, as soon as weather conditions permit, it will be flight tested. From all reports, this is the first aeroplane of this type that has ever been manufactured. A special litter, constructed in the fuselage and easily accessible by swinging lids, makes a very desirable aeroplane for the purpose of transporting injured persons. The physician or attendant is provided with a cockpit immediately in front of the litter and just back of the pilot's cockpit facing the tail surfaces. It is so situated that at all times the physician or attendant is able to observe the patient through a window which is cut in the fuselage. This type of ambulance aeroplane is a decided step forward in transporting injured persons by aeroplane.

Crissy Field Notes

On March 27th Master Sergeant William F. Hohorst and his seven "go-getters" returned to Crissy Field from their two weeks' recruiting trip, which has carried them through Healdsburg, Santa Rosa and Petaluma, at which latter place they established recruiting headquarters. Seven recruits have been added to the ranks of the Air Service as a result of this trip, and Sergeant Hohorst reports that were it not for the lack of transportation funds, this number could have been more than doubled. The eager interest and keen desire to join the Air Service manifested by the majority of prospective recruits approached by the men from Crissy Field, wavered, waned and finally resolved into inaction because of the lack of the necessary supply of "filthy lucre" to transport them to Crissy Field.

The national magnet at the present time seems to be Radio, which is rapidly drawing all men unto it. In its efforts to meet the demands of the thousands of radio "fans" in the Bay district, the University of California Extension Division requested the co-operation of Crissy Field, with the result that on Friday of last week Mr. Allen Smith, an Air Service Reserve Officer, who is at present connected with the University of California, announced from a Crissy Field ship in which was installed an SCR-68 telephone set, a course of lectures on radio to be delivered in San Francisco by Mr. Herbert E. M. Metcalf, a radio expert, formerly connected with the Air Service. Judging from the enthusiastic attendance at Mr. Metcalf's lectures, Mr. Smith's announcement was a "sho' nuf" "heavenly" message.



FOREIGN NEWS



London Papers on Paris Breakfast Table

With this week most of the London papers will be carried by air and will be available in Paris between 9 and 10 a. m., under arrangements made by Messrs. Hachette. Excellent!

Air Mail to Denmark

We understand that arrangements have been made for inaugurating, this month, an air mail service between Rotterdam and Copenhagen. The company which is to undertake the new service is stated to be Danish, although it is intended to use British machines and pilots. The plan is to have machines leaving Rotterdam in the morning, after the arrival of the night boat from London, and it is expected that they will be able to reach Copenhagen shortly after noon, so that the mails should be distributed early in the afternoon in Copenhagen. In the opposite direction machines will leave Copenhagen at 3 p. m., and will reach Rotterdam in time to connect with the night boat to London. Thus, instead of taking 72 hours, the mails between London and Copenhagen should do the journey in about 24 hours.

New British Empire Air Service Plan

Very considerable interest has been aroused by the announcement of the scheme for the formation of a company to establish an airship mail and passenger service to India and Australia. At the moment of writing, the decision of the Air Council in the matter has not been made public, consequently it is not known whether this scheme, which calls for no capital investment by the Government, but only a contingent liability in the form of a State guarantee of interest of £91,000 per annum, will mature. The proposal has the backing of Vickers, Ltd., and of the Shell group, and the details of the scheme were explained at a private meeting at Caxton Hall, on March 30, by Commander C. Dennis Burney. Mr. A. H. Ashbolt, Agent-General for Tasmania, who has long been one of the stoutest advocates of Imperial airship services, presided, and Major G. H. Scott explained certain technical considerations. If the scheme meets with Government approval, it will presumably mean that existing airships will not be handed over to the Disposals Board.

Briefly, the scheme submitted by Commander Burney to the Air Ministry is as follows: The company's capital of £4,000,000 would be made up of £1,800,000 in ordinary shares, and £2,200,000 in debentures, subject to the Government arranging, by means of a subsidy, a guarantee of dividend and interest for a period of years. On ordinary shares a 6 per cent. dividend (free of income-tax) would be guaranteed for 10 years, and the debentures would carry 4½ per cent. interest (free of income-tax) until redemption. It is proposed that £1,200,000 ordinary shares and £2,200,000 debentures should be issued forthwith, leaving £600,000 ordinary shares unissued.

Of this share capital, Messrs. Vickers, Ltd., have undertaken to subscribe for 100,000 shares at par and the Shell group for 100,000 ordinary shares or debentures at par. Both companies will give full technical assistance. It is stipulated that the Government shall transfer to the company free of cost all airships, airship material, and airship bases—such as Pulham, Cardington, and Howden, and will supply wireless telegraphy and meteorological services.

The total contingent subsidy per annum in the form of a guarantee of dividend on the ordinary shares and interest on the debentures (on the capital now proposed to be issued) would be:—On £1,200,000 ordinary shares, £72,000 for 10 years; on £2,200,000 debentures, £99,000 until redemption, divided as follows:—British, £91,000 per annum; Australia, £40,000; and India, £40,000. These dividend and interest payments would cease as soon as the profits from the company were sufficient to pay them. It is suggested that no dividend or interest should be payable until the middle of 1923, and accordingly the coming Budgets will be unaffected.

The program of development would be divided into two stages—(a) a bi-weekly service to India; (b) an alternate day service to India, with a weekly extension to Australia. Capital would thus be conserved until the necessary experience has been obtained, to render the service efficient on the first stage, before expanding to the second stage. Commander Dennis Burney asks that until time has been given for consideration of this offer no airship or airship material should be broken up or otherwise disposed.

It is estimated that, unless the public take to airship travel very rapidly, there will be a loss on running expenses for the first two years. During this period nothing will be earned to write off depreciation charges, but, on the other hand, experience will give rise to large improvements in the design of airships, and consequently the airships originally constructed by the company will become obsolete with more than normal rapidity. The cost of this will be about £750,000, and it is suggested that when the profits have reached such a figure as to relieve the Government from their guarantee of dividend upon the ordinary shares, and the company can show to the satisfaction of the Treasury that it has established the business on a commercial basis, the Government will refund to the company the £750,000.

Estimates of expenditure and revenue were also submitted. They provide for the building of five new airships (the present fleet will be used for training and for short journeys only). The new ships will be much on the lines of the "LZ125," so far as size is concerned, with a capacity of 3,800,000 cubic ft. On a bi-weekly service to India it is believed that there would be a return of £372,000 per annum, after paying all costs and depreciation charges. Details were also given of a proposed extension to Australia. The sum available for ordinary shares is estimated at £240,000 per annum.

For the first year of full service it has been assumed that receipts will only equal one-third of the running costs, or £130,000 as against a total earning capacity of £1,482,200, and for the second year total receipts of £260,000. It has been further assumed in the computation of dividends that when the service is in full working order yearly earnings of £1,037,000, against the total of £1,482,200, will be obtained.

The airships to be used would have a maximum speed of 70 knots,

and it is thought that an average speed of 55 knots could be maintained. It is proposed to establish bases with mooring masts *en route*, allowing six hours at each, the following time-table is estimated:

Bombay	5½ days	(now 17 days).
Rangoon	7½ "	(now 21 to 22 days).
Hong-Kong ...	8½ "	(now 4 to 5 weeks).
Australia	11½ "	(now 4 to 5 weeks).

To Advertise Air Travelling

A new scheme has been devised by the Lep Aerial Travel Bureau to display to prospective London air passengers the advantages of travelling to the Continent by air. A small daylight cinema of a new type has been erected in the bureau in Piccadilly Circus, and film depicting the Customs examination, start from the aerodrome, scene *en route*, etc., etc., are shown, while an official explains the film and points out the benefits to be obtained by using the newest method of travel.

Commercial Aviation in Germany

At least ten aviation companies are operating lines in Germany, says Economist Consul Parmelee, Berlin, in a report to the Department of Commerce. The 1921 returns of seven of these (data for the others not being available) show a total of 1,653,053 kilometers, 1,033,158 miles of flight, the transportation of 6,182 passengers, a 30,713 metric tons of mail and baggage. One company, the Deutsche Luft-Reederei, carried almost half of the passengers and three-fifths of the mail and baggage in flights totalling 346,826 miles.

The Deutsche Luft-Reederei has announced new routes to be open to Prague in Czechoslovakia and to Moscow by way of Koenigsberg and Wytbek.

The German Government grants a mail subsidy of 10 marks per kilometer on routes up to 300 kilometers and 11 marks for routes above 300 kilometers, provided time tables are strictly adhered to, a provided mail up to 100 kilograms per flight is conveyed free of charge. Payment is provided for overweight.

Companies are entitled to subsidy if they can prove a minimum record of 20,000 kilometers within a year. Payment of the total subsidy is dependent on at least 80 per cent. punctuality per month. Ten per cent is deducted for each 5 per cent. loss of punctuality. After April 1, 1922, only those companies are entitled to a subsidy who can prove that for every three military machines used they have purchased one of modern type.

As the subsidy is limited, the regular postal air traffic is to be suspended or limited from November 1 to March 31.

Owing partly to weather conditions, it has not yet been attempted to operate regular services the year round. The cessation during winter months is said to be due, in part, also, to the necessity of repairing the limited number of aeroplanes which have so far been available.

Article 202 of the Versailles Treaty and the subsequent London Ultimatum of May 5, 1921, have prohibited Germany either from manufacturing or importing aircraft. The note of February 1, 1922, however, has set May 5, 1922, as the date upon which resumption of construction, import and export of civil aircraft accessories will be permitted. All supervision of civil aviation in Germany will continue after May 1922, though the precise form which this supervision will take is not yet known.

Pretoria Experiment

The Meteorological Office at Pretoria is about to liberate balloons which instruments for determining the temperature and pressure of the air at various heights are attached. The balloon is quite free, ascends until it bursts and then acts as a parachute to the fall instrument which is secured to a "spider" constructed of the springs of bamboo about 3 feet 6 inches in length. At the six ends of the bamboo small red flags are attached and the spider is so arranged that, however it falls, three flags lie well above the ground to attract the attention of anyone passing in the vicinity. The success of the experiment depends on the recovery of the instrument and the Government offers a reward of £1 to the finder, provided he carries out the instructions on the label attached to it. The label reads: "Investigation of Upper Air. This instrument is a delicate meteorological apparatus. Pull out the piece of red string with match end attached and then convey carefully to nearest Magistrate. If the instrument has not been tampered with you will receive £1 reward."

Rome-Tripoli Service

To establish more rapid communications between Italy and Tripoli, the Secretary of the Colonies, Hon. Girardini, is endeavoring to organize an aerial mail service from Rome to Tripoli that may eventually be used also for the transportation of passengers. For this purpose the Superintendent of Aeronautics has granted the use of the airship *Superfiumo* (ex-Bodensee) to make its first flight, which will take place in the coming Spring. In the meantime, while they are completing certain works in order to prepare the aeroplane for her flight, her command, Major Valle, will go to Tripoli personally to make sure of a safe landing.

Palestine-Mesopotamia

The Palestine General Post Office has just announced the inauguration of a fortnightly mail service by aeroplane from Palestine to Mesopotamia according to a report received by the Department of Commerce from Consul Southard at Jerusalem. There has been a military service on this route for some time, from Cairo via Palestine and Transjordan. This announcement merely opens the service to the public.

ELEMENTARY AERONAUTICS

and MODEL NOTES

Elementary Aeronautics

Construction of the Navy Racer Model Trophy

BUILDERS of scale aeroplane models will be interested in the construction details of the miniature Curtiss-Navy model, recently presented to the Navy Department as a gift trophy by the Curtiss Aeroplane & Motor Corporation. The Curtiss Company designed and built the racing aeroplane in which Bert Acosta won the Pulitzer Trophy race at Omaha, on November 3d, last year. The successful flights of this plane created much enthusiasm among the naval officers responsible for its adoption by the Navy, and as a souvenir of the Omaha victory, the Curtiss Company had a special scale model constructed by its expert model builder.

Although many of the newspapers gave an account of the presentation, praising the fine appearance of the model, no mention was made of the actual construction and such information as desired by model builders. A representative of the Elementary Aeronautics page of AERIAL AGE interviewed the model expert who constructed the trophy, with the result that much intimate information was obtained concerning it.

All parts of the model were made and assembled by Mr. Thomas H. Birmingham, who is in charge of the Curtiss wind-tunnel model department. Mr. Birmingham has had considerable experience in building accurate scale models of steamships costing thousands of dollars. In the construction of model aeroplanes, whether for wind-tunnel tests or for display, he is able to carry out all the processes required for model complete in every respect. For example, many model builders excel in wood-work, metal-work or finishing details, but it is unusual to find one whose work testifies his skill in all these branches, while at the same time forming a model so accurately to scale.

In designing this trophy model it was desired to keep the wing span close to ten inches. To accomplish this, all the measurements of the large machine were scaled down to 1/16ths of an inch to the foot. The outline of the model is accurately to scale within about 1-1,000th of an inch, which is extremely fine work for a model of this kind. Altho this is accurate, the regular scale models made by Mr. Birmingham are even closer to the exact scale measurements, being within 1/4,000ths of the precise figures reduced in scale. Wind-tunnel work requires such accuracy, for the slightest variation in true scale would make the tunnel tests of doubtful value.

Of course in such models no attempt is made to reproduce the weights to scale, and each part is formed of materials most suitable for forming the correct outlines. Solid silver was used wherever possible. The wings, which have the appearance of silver, were made of aluminum. The forming of these wings to the correct profile was a difficult job, requiring more than a week of work by hand.

The two N struts are of silver. At each end a small pin is left to project into the wing for fastening.

Tail surfaces are of aluminum, formed by hand filing. The rudders to the fin and stabilizer, which on the real aeroplane are of steel, streamline wire are represented by fine silver wires on the model. Brace wires between the wings and on the undercarriage are also simulated by silver wires.

Undercarriage V struts and axle streamline are of silver. The wheels were turned out on a lathe; the material used was brass, silver-plated. Tires were represented by a coating of navy gray enamel.

The body was made of hardwood. It was divided into three parts vertically through the centerline, and the portion at the pilot's cockpit hollowed out. A miniature instrument-board, and windshield are installed. The body is finished with four coats of gray coach varnish.

The two "Lamblin" radiators, located on the chassis struts, below the lower wing, proved to be the most difficult part

to make. The real radiators themselves are of a complicated manufacture, and in reducing the parts in size, the complications were multiplied in proportion. Special moulds and dies were made to form the radiator shell, and the basket-like radiator tubes of silver-wire were arranged in their correct order by means of elaborate jigs.

At the rear of the body the steel leaf-spring tail skid is neatly arranged as on the real machine, with small overlapping spring leaves.

The base of the trophy is of turned ebony, polished. The pedestal shaft supporting the model is of silver, lathe-turned. A solid silver nameplate at the base is engraved with an inscription commemorating the winning flight of the Curtiss-Navy Racer, and bears the record of its speed over a "closed circuit" of 150 miles, which was covered in 52 minutes, 9 3-5 seconds, or at a speed averaging 176.7 miles an hour.

Insignias on the wings and rudder are of baked enamel, each color applied directly to the surface.

The propeller is made of maple, the grain of which, reduced at this scale, is in good proportion to the grain of oak, as used on the full size machine. It is formed and finished with all the care and exactitude of real propellers.

A month of time was required to build the model and its actual construction cost was about four hundred dollars.

The Flight Association of Ottawa, Canada, Organized

Mr. Oswald Barry announces the organization of a new club, formed for the purpose of model experimentation. The club has been named The Flight Association of Ottawa, Canada, and Mr. Barry is its president, pro tem.

The Association is composed of willing workers, and the constitution is so drafted as to exclude those who are not seriously interested in model building. Some of the members are quite proficient in the work, having followed the model game for eight years.

A cordial invitation to membership is extended to all those residing in that section of Canada, and the earnest tyro is quite as welcome as the seasoned veteran.

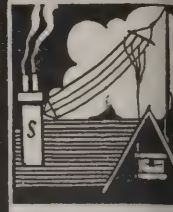
Correspondence is invited from other clubs and from individual model builders. Mr. Barry's address is 117 Albert Street, Ottawa, Canada.



The Curtiss-Navy Racer Model presented as a souvenir to the Navy Department to commemorate the winning of the Pulitzer Race



RADIO DIGEST



10,000 Radio Fans Hear Bride's Kiss in Aerial Wedding

A kiss struggled through the ether April 24 and 10,000 radio enthusiasts knew then that somewhere between Mineola, L. I., and Forty-second Street and Broadway, New York, 2,500 feet up in the air, Miss Sarah Cockefair and Albert P. Schlafke had been safely married.

Miss Cockefair, who is a nurse in Brooklyn Hospital, and Mr. Schlafke, who is physical director of the Veterans' Camp at Tupper Lake, decided that since they were going to be married anyway they might as well have as large an audience as possible.

A six-passenger Fokker was rigged up with a radio set. Bert Acosta agreed to pilot the ship. The Rev. Belvin Maynard, the "Flying Parson," was there to perform the ceremony. So the wedding party hopped off with Frank Daniels to attend to the radio, seven-year-old Louise Robb, winner of sixteen baby shows, as flower girl and George Weed to see that everything went properly.

The bride threw out her bridal bouquet of roses when she was 1,500 feet up and, when the plane was passing over College Point Lieutenant Maynard began the service. His questions and the responses could be heard plainly from an amplifier set up on the field and by all those who were listening in on their own radio sets.

The couple landed at 5:40 in a shower of rice.

Radio Equipment of the Ships "Paris" and "Lafayette"

Is described in a recent issue of *Radio-electricite*. On both steamers a 5-kilowatt tube transmitter has been installed with a wave range of between 2000 and 9000 meters. A 5-kilowatt motor-generator set is used to produce the plate high tension for four rectifying and four oscillatory tubes, and the low-voltage current for the heating of the filament of these tubes. Both vessels are equipped with a radio rangefinder, or "radio goniometer," which, reduced to plain English, means a radio compass. A distance of 3400 kilometers has been covered safely by messages sent from the transmitter of the "Paris."

The Radio Industry

It is evident that the radio industry has expanded to undreamed of proportions within the past few months. It is not surprising, therefore, to learn that one concern expects to do a business of well over \$50,000,000 this year, judging by the returns of the past few months. There is an ever-increasing demand for vacuum tubes; it is estimated that by this writing 75,000 tubes are being turned out a month, and that by the time this reaches the reader the production will probably exceed 100,000 tubes per month. Authorities in and out of radio are of the opinion that the radio business as it is now developing is going to be greater than the phonographic industry, which has been doing a business in excess of \$400,000,000 per year.

Efficiency of Radio Plants

In a recent issue of *The Electrician* there appears the following editorial

comment, which offers sound food for thought: "Apart from the press stunts, of which wireless has been the victim (or conspirator), the thing that most strikes the observer of progress in this branch of electrical service is the enormous disproportion between the hundreds of kilowatts utilized at the transmitting end and the few microwatts picked up at the receiver. No doubt this apparently inevitable state of affairs has had its influence upon those who have been engaged in the practical development of wireless, for it is only within recent years that any progress has been made in the rounding up and extermination of the losses which take place within the transmitting plant itself. The old spark transmitter had an efficiency in the neighborhood of 15 per cent; but it is only necessary to inspect the oil-cooling system of the high-frequency alternator, the water jacketing of the arc, or the red-hot anodes of the very latest transmitter, the 3-electrode valve, to realize that even present-day apparatus has far to go before it approaches the efficiencies now commonplace in low-frequency and direct-current work."

World-Wide Radio

Every leading nation is interested in establishing a system of world-wide radio. Germany had such a plan before the war, which had a distinctly military tendency rather than a purely commercial attempt to keep in touch with all countries, both far and near. Great Britain has had a world-wide radio plan for many years, and of late the subject has been very much in the forefront of British circles. It is understood that the present plan considers six principal centers between which reliable radio communication is required, namely—Great Britain, Canada, Australia, New Zealand, South Africa, and India. Geographical considerations suggested the postponement of Canada and New Zealand. Of the remaining four, Australia, South Africa, and India form an equilateral triangle about 5000 miles along each side, while England is about 6000 miles from South Africa, 5000 miles from India, and 10,000 miles from Australia. The United States has also a plan for world-wide radio, which is rapidly progressing towards realization.

Radio Link in Telegraphy

Experiments on substitution of a radio transmission link for the customary wire transmission lines on the commercial multiplex printing telegraph, have recently been carried on. Results are given of tests made between New York and Cliffwood, N. J., a distance of 25 miles. The usual outgoing signals from the printer were transmitted by wire to the radio room, where by means of a relay controlling the radio transmitter they were converted into radio signals. The received signals at Cliffwood actuated a polar relay and converted the radio signals back to wire signals which were relayed by wire back to the printed laboratory in New York. These tests showed that 180 words per minute could be satisfactorily sent, according to the *Journal of the Franklin Institute*.

WGY Heard 2,600 Miles

The wireless operator on the steamer Luckenbach has just sent word that March 30, between the hours of 3:50 and 4:38 in the morning, while the ship was south of Panama in the Pacific at several degrees north of the equator, he had been able to pick up a musical concert sent from station WGY in Schenectady. This is by airline a distance of more than 2,600 miles and establishes a new record for station.

The ship operator, W. W. Braire, reports the time he heard each selection, named each selection, and his letter bears a confirmation of the ship's location signified by the master of the vessel. His reports check up exactly with the log of the concert broadcasted that night.

Prior to the letter from the S. S. Luckenbach, the southernmost point reached by the Schenectady station was Tela, Honduras. Richard B. Dudley, chief operator on the steamship Coppename, tied up at the port of Tela, reported that he distinctly heard the program sent out from WGY on March 16. Other distant southern places which have reported hearing WGY are Santa Clara, Cuba and Mexico City.

Important Dates in Progress of Radio Telephony

The following are the outstanding events in the development of radio-telephony, as compiled by Professor Ph. R. Coursey. One of the most important of all, the invention of the vacuum tube, is omitted from the list, probably because it lies more in the province of sound than of pure radio. The events listed deal directly with the extension of range rather than of audibility.

1885—Experiments with the induction system were carried out by Sir William Preece at Newcastle-on-Tyne. A speaking range of 440 yards was obtained.

1894—Experiments with conduction system successful for distance of one and one-half miles across Loch Ness.

1887—The induction system was utilized in mines. Telephonic communications was established between the surface and subterranean galleries of Broom Colliery, 350 feet deep, by A. W. Heaviside.

1899—The conduction wireless telephony was installed between Skerries and Glenties. Average distance between stations, three miles. A similar installation was also put into use between Rathlin Island and the mainland of Ireland. Range of speech communication, eleven miles.

1900—Early experiments by R. A. Fessenden with a special high-speed commutator to obtain a rapid sparking of speech transmitted by ether waves over about a mile, but articulation not very good.

1899-1900—Experiments made with F. Collins's electrostatic method were successful up to 200 feet range.

1902—The range of Collins's tests extended to three miles. Articulation to be perfect.

1902—E. Ruhmer, in the course of extensive experiments with the photophone method, succeeded in telephoning over a distance of about four miles on Lake W.

ce, and subsequently at Kiel over a range of about twenty miles.

1906—Successful experiments carried out with a small high-frequency induction alternator by R. A. Fessenden. Ranges up to about twenty miles obtained.

1906—Tests of art transmitters made by Telefunken Company between Nauen and Berlin—twenty miles.

1907—The range of Fessenden's tests was increased to about 100 miles, using improved H. F. alternators.

1908—Tests with the Coln-Jeance apparatus were made from the Eiffel Tower. A range of thirty miles obtained.

1908—Experiments by F. Majorana, using an arc oscillation generator with his liquid microphone, were carried out from Rome to a number of other stations—including ships. The range of successful speech communication was gradually extended from about thirty-five miles to 156 miles (Rome to Sardinia), then to 180 miles (Rome to Maddalena), and eventually to 300 miles (Rome to Sicily).

1908—V. Poulsen succeeded in transmitting speech over a distance of about 10 miles, using his arc transmitter.

1909—Successful tests of Poulsen type arcs between Milwaukee and Chicago (ninety miles).

1909—Ranges of speech communication up to seventy-five miles obtained with Coln-Jeance arc apparatus; subsequently increased to 100 miles between Toulon and French cruiser, and ninety miles between Eiffel Tower and Dieppe.

1910—Experiments with H. P. Dwyer's apparatus gave perfect telephonic communication between San Francisco and Los Angeles—490 miles range.

1911—Range of speech communication from Nauen increased to about 350 miles (Nauen to Vienna).

1912—G. Vanni obtained a speech range of 600 miles between Rome and Tripoli, using the Moretti arc oscillation generator and the Vanni liquid microphone.

1913—Experiments at Nauen Station with 10,000-frequency alternator and static frequency raiser gave a range of 550 miles to Pola.

1913—Experiments at Nauen Station with 10,000-frequency alternator and static frequency raiser gave a range of 550 miles to Pola.

1913—Further experiments carried out with the induction system in mines demonstrated its special utility for such purposes. Communication was successfully established between the surface and a level 80 feet deep.

1914—The T. Y. K. arc system was first put into practical use at Toba.

1914—Successful speech communication from Brussels to Paris, 190 miles, using Moretti arc transmitter and Marzi's carbon powder microphone.

1914—Experiments carried out by G. Marconi with the oscillating valve transmitter on Italian war vessels. Ranges up to forty-five miles were obtained, using very limited power at the transmitter.

1915—Tests of oscillation valve transmitters gave successful communication between New York and California, 2,500 miles.

1915—The American Telephone and Telegraph Company carried out a series of very successful experimental tests with the arc type transmitters. Eventually the Atlantic was bridged between Arlington (Va., U. S. A.) and the Eiffel Tower, France, 3,800 miles, and good speech communication was also established between Arlington and Honolulu, a distance of over 5,000 miles. Articulation was said to be faint, but very clear and recognizable.

1918—Considerable development of wireless telephone apparatus for communication with aircraft. Successful results obtained up to about 100 miles between aeroplanes in flight, and up to about 150 miles between aeroplanes and the ground.

1919—Successful wireless telephone communication established between the British Isles and Canada by special valve apparatus developed by the Marconi Company.

Business Firms Use Radiophone

The farmers in the Middle West for some time past have been receiving their weather and crop reports over the wireless telephone, broadcasted by the Government. Now enters the New York business man who sees a step forward in the adoption of the wireless telephone for general business.

Kaye & Einstein, manufacturing furrriers, have installed a wireless telephone receiving station, which is connected with each of their nine selling booths. A customer in these booths can pick up a receiver at any time, and listen to market reports, news of the day, crop and weather conditions throughout the country, financial reports, or the machine can be adjusted so that he will receive the music of a concert to soothe his frayed nerves. The machine has an amplifier connection with the factory, so that the working people may receive music and entertainment during working hours. The outfit is a very powerful one and will pick up messages from Pittsburgh, Chicago and points from a greater distance.

Built-in Vernier Best

If the very best is desired in a set that employs variable condensers for tuning, get condensers that have verniers built in. These are two-plate condensers, mounted directly on the main shaft and controlled by a separate arm. Rough adjustments are made on the big condensers, and very fine regulation is made with the verniers. The latter, before being touched, should be kept in half way, so that adjustments can be made either way, as necessary.

Grid Leak Important

Too much emphasis cannot be laid on the importance of the necessity of the right value of the grid leak. If it is not correct the set will howl unmercifully. Do not buy grid condensers with the leaks already built in. Buy a separate grid condenser, and either make or buy a leak that can be varied easily, such as the pencil line type. If the set does howl, try rubbing out some of the lines, and if the set doesn't work the way you think it should, try rubbing some more on.

New Regulations Use Radio to Aid Seaplane Fliers

Seafaring aeroplanes will be as safe as a chair at the opera if all the new regulations announced by Secretary of the Navy Denby are strictly enforced.

The regulations provide that all aeroplanes that make long passages be equipped with radio sets of sufficient strength to communicate with a ship or station at the near end of the passage. Machines will be required to go in pairs in all cases where a forced landing in a locality where any difficulty in finding a place of landing for the machine might be encountered. Even if a 'plane is equipped with a satisfactory radio set, it may fly so near to the ground in inclement weather that it would find it impossible to signal distress between the time that the engine fails, and the moment of landing. As stated in the announcement recently made by Secretary Denby, "When one machine is forced to land sud-

denly, the other finds out by a visual signal whether its mate needs help or whether repairs can be made in a few minutes.

"If the aeroplane down is able to continue its flight in a few minutes, the machine in the air continues circling overhead, makes a radio report of the circumstances, and when its mate has taken off, reports that the flight is resumed. If the aeroplane down must take a long time to make repairs or require a tow to get to port, the machine in the air reports the circumstances by radio and then goes alone to its destination."

In cases of distress when immediate assistance is needed the second machine flashes a report to this effect, and then lands, where possible, to lend assistance to the disabled 'plane.

In addition to making forced landings the leader of each pair of 'planes will be required to make a report of their position each half hour. If both 'planes are forced down simultaneously, then, with opportunity for flashing a signal, the ship or station will be able to approximate their position with a fair degree of accuracy.

Congressman Proposes Radio Station in Capital

The bill introduced by Congressman Vincent M. Brennan of Michigan, serving his first term in the House of Representatives, to install a powerful radio transmitter on the floor of the House, indicates an entirely new field of radio activity.

Hitherto the radio has been employed on a large scale to broadcast news of public events—reports of political events, athletic and sporting contests, public conditions, etc.—but with the passage of Congressman Brennan's bill and the subsequent opening of the Congressional station, the events themselves would be broadcasted. It would be the difference between seeing a prize fight and reading about it in the newspapers.

Entire new vistas open themselves if this measure is approved. Wireless transmitters at diplomatic parleys, thus actually obtaining "open covenants openly arrived at." Perhaps some day it will be possible to get all the thrills of a murder trial without being crushed by the mob struggling to get in the court room.

Aerial Still Perplexes Many Beginners at Radio

The aerial is a point that has not yet been thoroughly cleared up in the minds of many beginners. The aerial should be composed of one wire about 100 feet long. Remember that two wires each fifty feet long will not give the same results and also that the aerial should run all in one direction. The aerial that is full of bends is not very efficient and a straight line aerial is far superior. The lead-in should always be taken from one end, as the T aerial is not particularly good for receiving. The short end of such an aerial is absolutely wasted, and is not helping the set a single bit. The indoor aerial is not much good unless there are several stages of amplification used, and is far below the outdoor aerial in efficiency. Several people have written in, disputing this claim, but probably their outdoor aeriels have not been constructed correctly. The indoor aerial will not work with a crystal set unless the owner is located very near the station that he wants to receive.

The wire in the aerial should be of copper of almost any size as long as it is strong enough to support its own weight. Remember that some of the smaller sizes of wire will not withstand the rigors of a sleet storm, and the owner does not want to keep erecting a new aerial every time it comes down.

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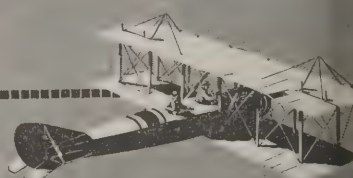
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AERIAL AGE

WEEKLY

Vol. 15, No. 10

MAY 15, 1922

10 CENTS A COPY

Raymond D. Harris
Including Radio Section



The National Spring Flying Meet at Curtiss Field Photographed by the Fairchild Aerial Camera Corporation

**Navy to Use Metal Planes—Landing
Fields in the United States—
The Versatile Aeroplane**

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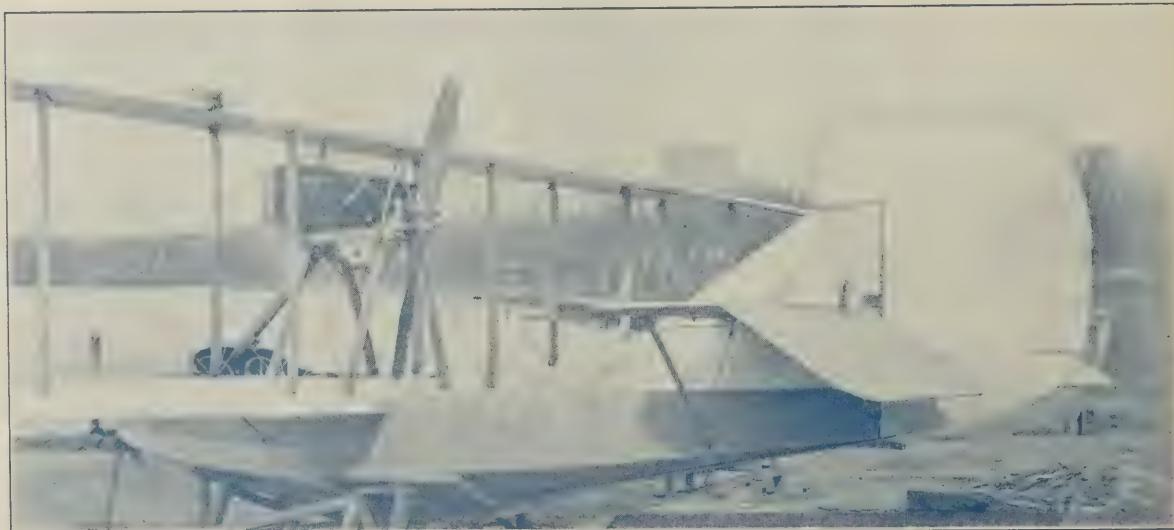
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MF Flying Boat, two seater, with 100 H.P. OXX 6 motor
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Correspondence with Distributors invited

May 15, 1922



Vol. XV, No. 10

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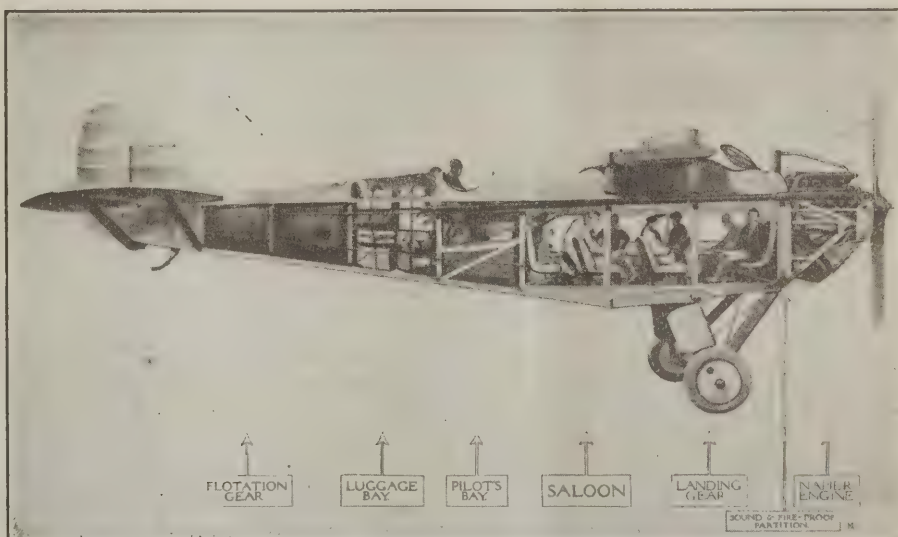
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Art Editor

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OL. XV

NEW YORK, MAY 15, 1922

No. 10

Navy to Use Metal Seaplanes

SECRETARY DENBY of the Navy Department on May 7 authorized an announcement that the Glenn L. Martin Company of Cleveland, Ohio, has undertaken the development for the Naval Bureau of Aeronautics of a number of seaplanes to be constructed of duralumin, a special alloy of metal, and to be used by the fleet for spotting gunfire at long ranges.

The construction of metal aircraft of duralumin is a departure for this firm, which hitherto has built planes of the ordinary wood and wire type, such as the well-known Martin bombers which were used last Summer in the aeroplane bombing attacks that destroyed a number of former German ships at the entrance to the Virginia Capes.

The development of metal aircraft construction in the United States, Secretary Denby said, has been made possible by the Navy Department in that the special alloy metal, duralumin, originally developed in Germany, has been introduced to American manufacturers in connection with the construction of the rigid airship ZR-1 at the naval aircraft factory at Philadelphia. This work has now progressed to the point, according to naval aviation experts, where duralumin of proper quantity, and in all of the useful shapes is now available to an aircraft builder from at least two American commercial sources. The naval aircraft factory at Philadelphia has also developed special machinery and processes for its fabrication.

Aircraft manufacturers transacting business with the Bureau of Aeronautics of the Navy have been invited frequently to visit the factory at Philadelphia to observe the metal fabrication of the work that is going on there. Besides the construction of the rigid airship ZR-1, the parts of which are being manufactured at Philadelphia for erection at the naval air station at Lakehurst, the factory is also building metal wings, pontoons and other parts for seaplanes.

Just as the surface fleet of the navy passed by the stages of evolution through the era of wood into that of steel, so it is predicted by experts that the air fleet of the naval service will proceed from the period of wood and linen to that of metal.

Secretary Denby said that the Stout Engineering Laboratories, Inc., of Detroit, were also working with duralumin. This firm has received a contract from the Navy Department for the construction of experimental torpedo-carrying seaplanes to be built entirely of metal, and a simple machine of this character is now under trial flights. Other manufacturers in work for the Navy, it was disclosed, have employed duralumin for parts of aeroplanes with success, notably the Galveston Aircraft Corporation of Providence, R. I., and the Marine Plane and Motor Company of Keyport, N. J.

It is expected," said Secretary Denby, "that future naval aircraft will be built of metal, to an increasing extent. The advantages of metal over wood are especially important for naval service."

New Recording Devices

AFTER nearly twenty years of flying without knowing just how it was done, new instruments have been devised by the aeronautical experts and pilots of the National Advisory Committee for Aeronautics by which can be recorded what an aeroplane pilot does and how the aeroplane responds. Three special instruments have been perfected to record the speed of the aeroplane in the air, the loadings or changings in weight on the wings and the movement of the controls by the pilot.

Although these instruments are fairly complicated, their operation is simple and mechanical. The recording is done by means of a photographic film. The results reveal for the first time a practical method of securing information in testing new types of aeroplanes and of determining the ability and technique of a pilot. The last function of the instruments will be of great value to the pilots themselves and to instructors of novices, who are seldom able to recall just what they did with the controls at a certain point of a flight.

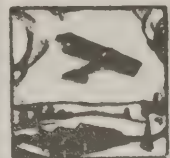
The first of these new instruments is an air speed meter. Another is used for recording variations in the loading on the wings in flight and the landing carriage when landing, taking off, or running along the ground. In flying through a loop, for example, the pilot is sitting down hard as he goes up and again as he flattens out, but he is literally hanging in his belt at the top of the loop. It is these variations in load on the wings due to the weight of the aeroplane and the aviators in the air, that are recorded by this instrument and also the weight on the carriage while on the ground.

The third device—a control-position recorder—indicates the exact position of all the controls during any manoeuvre or part of a flight. When the pilot gives his ship left-rudder it is recorded in degrees. When he dives by pushing on his "stick," or pulls it back to lift the nose, the movements are shown on the record of the flight. After he lands, there is no argument to what he did, for it is plotted from an automatic record. If one pilot reported that a certain aeroplane was not controllable, he could be checked up by having another pilot put the aeroplane through the same manoeuvres, and then comparing the records of both pilots as delineated by the new instrument.

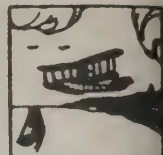
"These three instruments," the National Advisory Committee for Aeronautics said in a statement issued to-night through the Navy Department announcing their development, "are synchronized to operate simultaneously by means of a timing device which makes possible the co-ordination of the three records into a composite one for study and analysis. The instruments themselves are not bulky, and they do not interfere with the movements of the pilot or the operation of the aeroplane. All the attention they require is the throwing of a switch before a manoeuvre is begun and when it is completed to set them all in operation and to stop them."

"When the flight is completed the photographic records with their delineations of the pilot's movements and the aeroplane's

(Concluded on page 232)



THE NEWS OF THE WEEK



British Airship R-36 Declined by America

The United States Government has declined an offer by the British Government to turn over the rigid airship R-36 in final settlement of the account over the destruction of the ZR-2.

It is understood the reason for the American refusal to take the airship was based on the fact that to change her back from commercial to military service would mean a large expenditure of money, which Congress might be unwilling to provide.

Further, it has been decided, for the present at least, to keep clear of foreign built airships, this being determined upon in consequence of the loss of the ZR-2 and the Roma.

The American Government, however, has not abandoned airships, and is going ahead with the construction of the ZR-1, at Philadelphia and Lakehurst, N. J. It will be a year, however, before the airship is finished.

British World Flight

LONDON.—Major W. T. Blake of the Royal Air Force has been invited to take the place of Sir Ross Smith in the proposed round-the-world flight, The London Evening Star announced April 27.

Major Blake told the Star he was taking Captain Norman MacMillan, but he had not decided on the type of flying machine to be used. The route will be through France, Italy, Greece, Egypt, Mesopotamia, India, Eastern China, Japan, thence via the Aleutian Islands across to Alaska, through the United States to New York, thence to Newfoundland and then across the Atlantic via Greenland and Iceland to Scotland.

Major Blake expects to start about the end of May and plans to complete the trip in two months.

Protests Against Reduction Appropriation Army Air Service

Protests were made by Major Gen. Mason M. Patrick, Chief of the Air Service, and Brig. Gen. William Mitchell, Assistant Chief of the Air Service, in a hearing that was accorded them by the sub-committee of the Senate Committee on Appropriations on April 12. They were accompanied by Lieut. Col. A. L. Fuller and Major J. Y. Chisum, of the Air Service, and Dr. R. B. Moore, Chief Chemist of the Bureau of Standards.

General Patrick discussed at length the reduction that would restrict the activities of the Service with the Organized Reserves and the R. O. T. C. General Mitchell discussed lighter-than-airships, and the importance of maintaining the enlisted personnel of the Air Service.

General Patrick objected very seriously to the cut of \$260,000 made by the House in the appropriations for civilian personnel. He showed how this would interfere with the operations of the Service. The general explained that the House had made a reduction of \$810,000 in the allowance for normal operations; a reduction of \$201,000 in the appropriations for field hangars. He also called attention to the importance of appropriating sufficient funds for experimental research, so as to keep the Service abreast with the progress of aviation.

General Mitchell, who recently returned from Europe, strongly argued for adequate appropriations for lighter-than-airships. He pointed out the value of lighter-than-airships, giving an account of how aeroplanes were launched from dirigibles. He also described how experiments in foreign countries were being made by landing aircraft on suspended wire-arrestors. These wire-arrestors, he explained, would greatly increase the value of lighter-than-airships.

General Mitchell in discussing the personnel problems declared that it was necessary to keep up the enlisted personnel of the Air Service in order to maintain the equipment of the Air Service.

Both urged legislation for a distinguished flying cross to be awarded for extraordinary hazardous and important missions in the Air Service. They cited an instance of the Atlantic Ocean flight as a need for such a decoration.

Dr. Moore explained the necessity for an increase of the appropriations for helium gas, if the gas was to be manufactured in sufficient quantities for the Army and Navy.

Kentucky Encourages Aviation

That the State of Kentucky is fully cognizant of the important rôle slated for aviation in the economic and industrial life of the country is manifested by the recent action of the State Legislature in passing a Resolution requesting 'all towns and cities in the Blue Grass State to print in large letters the names of such respective towns and cities in such conspicuous place as may be observed by aviators passing over such towns and cities.

Captain Harry B. Flounders, Air Service, stationed at Camp Knox, Ky., is directly responsible for the introduction and passage of this Resolution. This officer is also endeavoring to work up interest in aviation in the other states of the Fifth Corps Area, in order to have a similar Resolution passed. Officers stationed at Godman Field, Camp Knox, Ky., are giving lectures at various localities throughout Kentucky, and the State is taking a very active interest in the development of aviation.

It is hoped that the worthy example set by the State of Kentucky will soon be followed by the other states of the Union, as the importance of such identification signs cannot be overestimated. Several aviation accidents have occurred by virtue of the fact that aviators have lost their bearings and, being forced to fly low in order to catch some identification sign of the town, they were flying over, collided with some telegraph wires or a building or found it necessary to land in a restricted place.

The Resolution, as passed by the Commonwealth of Kentucky, is as follows:

"Whereas much interest is being taken in the subject of aviation, especially in the subject of carrying the mails by such method, and,

Whereas aviators experience much difficulty in ascertaining the name of many towns and cities over which they are flying; and,

Whereas there are but few natural objects near the many towns and cities in this Commonwealth whereby such aviators passing over the same can ascertain the

names of such towns and cities; therefore, Be it Resolved by the General Assembly of the Commonwealth of Kentucky:

Section 1. That the Mayors of all towns and cities in this Commonwealth are hereby requested to have painted in letters sufficiently large to be seen at a considerable distance, the name of their respective towns and cities upon the top of some building or eminence in order that aviators in passing over such towns and cities may be able to ascertain readily the name of such town or city.

Section 2. That the Clerks of the Senate and the House of Representatives of the General Assembly of Kentucky shall transmit certified copies of this resolution addressed to the Mayor of each town and city in this Commonwealth."

Spokane News

Spokane, Wash.—With the status of the Parkwater municipal aviation field settled as under the direct control of the city park board with regulations to be governed by federal rules, C. H. Messer, head of the United States Aircraft Corporation, has announced plans for extensions, including immediate reduction in rates.

A new three-passenger and pilot plane has been put into service, in which a party of three can make a trip anywhere. It will be operated by Nick Mamer, chief pilot for the concern.

Work has begun installing radio equipment at the hangar and on the ship. Workmen also began the construction of markers on both the lower field, now in use, and the upper or east-end field, at the northeast corner of the city's tract.

At its last meeting the park board decided to make no lease for the field and to operate it as a municipal field, open to the public, with any flyer being privileged to use the field by the securing of a permit and the payment of \$5 per ship per season. Desire to foster aviation, rather than to get money out of the field, prompted the board in its action.

Mr. Messer, who now uses the field and has a hangar for four ships constructed there, was given the first permit.

Tom Symons and Bill Barnard, local flyers, announced that they would make Mr. Messer's hangar their headquarters here.

An agency for Curtiss ships and products has been secured by Mr. Messer.

Aero Club of Jordan, Mont.

An aero club has recently been organized at Jordan, Mont., as an auxiliary of the Aero Club of Miles City. The members and officers are: Mr. Floyd Tolleson, President; Mr. S. C. West, Vice President; Mr. G. B. Hart, Secretary; Treasurer; Mr. H. A. Hetherington; and Mr. George Ayer. These are all prominent business men in their town which is located 40 miles from the nearest railway.

Medina Aviation Club

The Medina Aviation Club has been organized at Medina, Ohio. H. R. Calve is president and general manager, A. Pritchard, secretary and treasurer, W. Goebel, instructor, and J. A. Ray, chief mechanic. The club has taken over the Budd Sanford outfit of Brunswick, Ohio and is operating a "Canuck" and a "Waco Model 4, built by the Weaver Aircraft Co."

The AIRCRAFT TRADE REVIEW

Cox-Klemin Purchase M.F. Boats

The Cox-Klemin Aircraft Corporation, of College Point, Long Island, have purchased 57 M.F. flying boats from the Navy Department. The boats are in excellent condition, the majority of them never have been uncrated. Some of the boats will have 0xx6 motors installed, and those who desire a more speedy boat will have 180 h.p. Hispano motors.

Business Men Willing To Pay Air Mail Rates

Washington.—Business men generally would be willing to pay extra postage on air mail provided the safety of the mail and quick and certain delivery could be guaranteed, representatives of the Aeronautical Chamber of Commerce, the Merchants Association of New York and other organizations contended April 28th before the House Postoffice Committee. The Steenerson bill, under which the Postmaster general would be authorized to provide star air routes, was up for hearing.

F. B. De Berard, of the merchant's association, said if a highly improved method for expediting the mail were adopted, the public would rapidly avail itself of its use. But to be effective the aeroplane service must be operated by night, with plenty of equipment and landing, repair and supply stations, he added.

The Steenerson bill would fix the first class rate of postage on air mail at not less than 6 cents for each ounce or fraction, and would authorize the Postmaster General to contract with companies for transportation of first class mail by aircraft at a rate not exceeding two mills a pound a mile, and mail other than first class at a rate not exceeding one-half a mill a pound a mile.

Weaver Aircraft Company Moves

The Weaver Aircraft Company, manufacturers of the "Waco" Model 4 and the "Cootie" one-passenger baby plane have moved to Medina, Ohio, thirty-five miles southeast of Lorain, and are now manufacturing several planes on contract. They are receiving a large number of inquiries from all parts of the country regarding the "Waco" Model 4.

Air Mail Division Sale

Sealed proposals will be received at the office of the Second Assistant Postmaster General, Washington, D. C., covering certain aeronautic equipments, full details of which can be secured from C. F. Egge, General Superintendent, Air Mail Service.

The Santa Maria

The Aeronautical Chamber of Commerce of America, 501 Fifth Avenue, New York City, on April 26 pointed to the safe arrival at Nassau of the flying cruiser "Santa Maria" (mentioned in newspaper dispatches from Miami, Florida as having been out overnight in the Gulf Stream) as another indication of the safety of over-water, aerial transportation when conducted by a Company sufficiently well organized and financed to maintain their equipment in the best possible condition.

The "Santa Maria" which is operated by the Aeromarine Airways left Key West

for Nassau Monday on a three hundred and fifty mile emergency flight.

Due to the fact that they were compelled to buck a strong head wind which greatly retarded their speed, the pilot on seeing that his gas supply was getting low decided to come down at Billy Island in the Bahamas and after sighting a small harbor made a safe landing, taxied up to the beach and awaited gasoline which he knew would be sent out by the relief boat.

In the meantime, the passengers amused themselves strolling up and down the beach and preparing a good dinner from the supply of rations aboard the ship.

As soon as possible the passengers were transferred to a fishing schooner and taken on to Nassau. When the Navy flying boat under the command of Captain Bartlett and Lieutenant Miller located the "Santa Maria" they sent out a wireless stating where she was located, then made a landing and supplied the "Santa Maria" with sufficient gasoline and she continued on her course to Nassau.

The Aeromarine Airways, which operates a fleet of flying boats between Florida and points in the Bahamas and the West Indies, have flown over 150,000 miles, carried over 10,000 passengers without a single serious mishap.

In commenting on the experience of the "Santa Maria," C. F. Redden, President of the Company said: "We did not have the least apprehension for the safety or even the comfort of the passengers on the "Santa Maria" because the boat is as much in its element on the sea as it is in the air. It was equipped with two 400 horsepower Liberty motors and even tho they were compelled to land at sea on account of motor trouble, the auxiliary motor would enable her to taxi to some safe harbor.

"The boat is a huge eleven-passenger enclosed-cabin cruiser provided with sufficient food and water to maintain its passengers for a week and the big reclining chairs and settees which are more comfortable than the average Pullman reclining chairs were such that the passengers need suffer no hardship either night or day.

"Our system of rigid inspection and maintenance has enabled us to operate successfully for two years without serious trouble and the wonderful record of these flying boats in the service of the United States Navy is an eloquent testimonial to their sea and air worthiness and general reliability."

The "Santa Maria" will leave Nassau in a few days for Washington and New York where it will be in regular service between New York and Atlantic City.

Assistant Aeronautical Engineer

The United States Civil Service Commission announces an open competitive examination for assistant aeronautical engineer. A vacancy in the position of aeronautical engineer, Naval Aircraft Factory, Navy Yard, Philadelphia, Pa., at \$7.20 per diem, and vacancies in positions requiring similar qualifications, at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest

of the service to fill any vacancy by reinstatement, transfer, or promotion.

Applicants should apply for form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.

The Airplane Engine

The author, Lionel S. Marks, Professor of Mechanical Engineering, Harvard University, presents in this book a treatment of the aeroplane engine that is so thorough and detailed that it will be accepted at once as the standard work in this field.

It is the first adequate discussion of the aeroplane engine, design and construction to be published in this country.

It is based mainly on the researches and engine developments originating during the war and resulting from the war's urgencies. It includes the results of investigations carried on by the United States, the British, the French and the German governments.

The chapter headings are: Power Required and Power Available, Engine Efficiencies and Capacities, Engine Dynamics, Engine Dimensions, Materials, Engine Details, Valves and Valve Gears, Radial and Rotary Engines, Fuels and Explosive Mixtures, The Carburetor, Fuel Systems, Ignition, Lubrication, The Cooling System, Geared Propeller Drives, Supercharging, Manifolds and Mufflers, Starting, Potential Development.

Pistons

The Aluminum Manufacturers, Inc., Cleveland, have just published "Pistons—A Reference Book," which should be in the hands of every engine mechanic. It discusses the functions of pistons, piston troubles, piston design, and things to be observed to insure successful piston operation.

COMING AERONAUTICAL EVENTS

AMERICAN

- May —National Balloon Race.
- Sept. 4.—Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
- Sept. 15.—Detroit Aerial Derby, (about) Detroit. (Pulitzer Trophy Race.)
- Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

- Aug. 1.—Coupe Jacques Schneider. (about) (Seaplane speed race.) Italy, probably Venice.
- Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.
- Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

LANDING FIELDS IN THE UNITED STATES

The following landing fields have been reported to the Office of the Chief of Air Service, War Department, since January 1, 1922:

Arkansas

Ogden.—Latitude 33° 35' N., longitude 94° 00' W.

Reported by the National Aircraft Underwriters Association; no data.

Van Buren.—Latitude 35° 24' N., longitude 94° 21' W. No data.

California

Colfax.—Latitude 39° 07' N., longitude 120° 57' W.

Small emergency field, 600 by 300 feet; soft, wet, level; ½ mile south of city; altitude 2,422 feet.

Courtland.—Latitude 38° 20' N., longitude 121° 30' W.

Emergency; 129 miles from Reno, 58 miles from San Francisco; nearest railroad station, Hood; long distance telephone only; gas and oil; ½ mile east and 3 miles southeast of town are large level cultivated fields where safe landing could probably be made, but take-off difficult owing to soft ground or growing crops. Landmark, Grand Island Drawbridge, 2¼ miles south of town.

Elsinore.—Latitude 33° 40' N., longitude 117° 20' W.

Emergency, good; located south of town and railroad, one mile west of river and north of lake; square; 40 acres; garage service; altitude 1,300 feet.

Franklin.—Latitude 38° 25' N., longitude 121° 25' W.

Emergency; 122 miles from Reno, 65 miles from San Francisco; Western Pacific Railroad; long distance telephone and telegraph; gas and oil; tract for landing field adjoining town and ¼ mile southwest of railroad. Landmarks, church in one corner of field, Western Pacific Depot, and Great Western Power Company's towers.

Freeport.—Latitude 38° 27' N., longitude 121° 30' W.

Field 1,800 by 2,000 feet, located 115 miles from Reno and 72 miles from San Francisco, on Southern Pacific Railroad. Long distance telephone only; gas and oil. Landmarks, two steel towers, 185 feet high, one on each side of the Sacramento River, west of town.

Garden Valley.—Latitude 38° 52' N., longitude 120° 50' W.

Field 72 miles from Reno, 115 miles from San Francisco; nearest railroad at Placerville. Southern Pacific, about 12 miles by road. Long distance telephone only; no supplies; not a good landing place; very rocky and hilly.

Georgetown.—Latitude 38° 55' N., longitude 120° 50' W.

Field 70 miles from Reno, 117 miles from San Francisco; 18½ miles to Placerville, nearest railroad station; long distance telephone only. Field unplowed land 1,800 by 3,000 feet, located 1 mile east of town; slight grade, no obstructions; a large isolated hill on eastern boundary.

Holtville.—Latitude 32° 45' N., longitude 115° 24' W.

Emergency; southeast and near town; 2,500 by 2,500 feet; another field further southeast.

Mills.—Latitude 38° 36' N., longitude 121° 20' W.

Mather Field, 103 miles from Reno, 84 miles from San Francisco, on Southern Pacific Railroad; long-distance telephone

and telegraph. Field 1 mile south, American River 1 mile north of town.

Natoma.—Latitude 38° 40' N., longitude 121° 12' W.

95 miles from Reno, 92 miles from San Francisco; long-distance telephone only; supplies; field covered with dredge tailings. Land at Folsom, 1½ miles north. Natoma painted on both sides of barn.

Perris.—Latitude 33° 48' N., longitude 117° 15' W.

High School Field, ¼ mile north, near school and between railroad and boulevard; 30 acres; good in wet weather; supplies; another field 1 mile southeast.

Polaris.—Latitude 39° 23' N., longitude 120° 10' W.

Emergency; 22 miles from Reno, 165 miles from San Francisco, on Southern Pacific Railroad. Long-distance telephone only; no supplies; possible landing 1 mile north.

Seeley.—Latitude 32° 50' N., longitude 115° 42' W.

Municipal Field (for air mail) west of town; railroad and highway run east and west; supplies.

Shingle Springs.—Latitude 38° 40' N., longitude 120° 54' W.

7 miles south and east of the air-mail course, on the Placerville branch of the Southern Pacific Railroad. Field 1,500 by 300 yards, ½ mile west of town, bounded by the highway on the south and the railroad on the north; level, hard, and smooth; altitude 1,000 feet.

Slatington.—Latitude 38° 50' N., longitude 120° 48' W.

73 miles from Reno, 114 miles from San Francisco, 6 miles to railroad station at Placerville; telephone and telegraph; supplies; many suitable landing places.

Suisun.—Latitude 38° 15' N., longitude 122° 03' W.

Field 2,000 by 5,000 feet; in a strategic position for flying in the Sacramento valley; level, bounded by fences and road on the south; supplies; altitude 100 feet.

Truckee.—Latitude 39° 20' N., longitude 120° 13' W.

Good summertime landing, 600 by 2,000 feet, near the junction of Lake Tahoe and Southern Pacific Railroads; deep snows in winter. Maintain altitude of 15,000 feet in crossing the Sierras at this point. Landing field prepared by the citizens 3 miles out on the highway; supplies.

Tracy.—Latitude 37° 43' N., longitude 121° 27' W.

Emergency; ball ground, 1,600 by 1,100 feet, between railroad branch and six big tanks and water tower.

Wilmington.—Latitude 33° 44' N., longitude 118° 17' W.

Smith Aircraft Company's field, 1½ miles west of town, 2,000 by 1,000 feet along the boulevard; good in any weather.

Winchester.—Latitude 33° 42' N., longitude 117° 06' W.

In Domenegoni Valley; no data.

Yosemite.—Latitude 37° 45' N., longitude 119° 37' W.

National Park Field.

Colorado

De Beque.—Latitude 39° 20' N., longitude 108° 13' W.

Emergency field in vicinity.

Gypsum.—Latitude 39° 42' N., longitude 106° 55' W.

Emergency field in vicinity.

Malta.—Latitude 39° 16' N., longitude 106° 20' W.

Level fields for emergency landings; altitude 9,580 feet.

New Castle.—Latitude 39° 34' N., longitude 107° 32' W.

Level fields for emergency landings.

Riverside.—Latitude 38° 57' N., longitude 106° 12' W.

Level fields for emergency landings.

Wolcott.—Latitude 39° 41' N., longitude 106° 41' W.

Level fields for emergency landings.

Connecticut

Stamford.—Latitude 41° 03' N., longitude 73° 32' W.

Halloween Park, emergency, 2½ miles south of town.

Florida

Apalachicola.—Latitude 29° 44' N., longitude 84° 58' W.

Landing for seaplanes only.

Green Cove Springs.—Latitude 29° 29' N., longitude 81° 41' W.

Landing for seaplanes only.

Palatka.—Latitude 29° 19' N., longitude 81° 38' W.

Landing for seaplanes only.

Georgia

Thomasville.—Latitude 30° 53' N., longitude 83° 58' W.

Spence Field, municipal, 1,100 by 350 feet; good in wet weather; marked by a T within a circle; between highway and railroad; altitude 275 feet.

West Rome.—Latitude 34° 07' N., longitude 85° 06' W.

Reported by the National Aircraft Underwriters' Association; no data.

Idaho

Hope.—Latitude 48° 15' N., longitude 116° 20' W.

Field situated halfway to Sand Point, north of lake.

Lewiston.—Latitude 46° 25' N., longitude 117° 03' W.

Emergency; good; 2,100 by 3,000 feet; northwest of race track; marked by T; altitude 750 feet.

Illinois

Ashburn (Chicago).—Latitude 41° 45' N., longitude 87° 40' W.

Aero Club of Illinois Field; 10 miles from Congress Hotel; one mile square; three hangars; soggy when wet; supplies and service by Ralph C. Diggins Company Flying School. (See Notice to Aviators 3 (24) of 1922).

Beardstown.—Latitude 40° 01' N., longitude 90° 25' W.

For seaplanes only; difficult landing in cross winds; flying boat anchor must be used; fuel ordered in advance.

Cairo.—Latitude 37° 00' N., longitude 89° 11' W.

For seaplanes only; flying boat anchor must be used; fuel ordered in advance; Chamber of Commerce will cooperate.

Indiana

Anderson.—Latitude 40° 05' N., longitude 85° 40' W.

32 acres rented and operated by Mr. E. B. Bridges.

Iowa

Missouri Valley.—Latitude 41° 32' N., longitude 95° 55' W.

Field of Missouri Valley Aero Co.; hangars, etc., Messer Pasture.

Webster City.—Latitude 42° 28' N., longitude 93° 48' W.

Field of the Webster City Aero Com-

pany; on northwest edge of town; 50 acres; ideal; canvas hangars; marker; high test gas and oil.

Kansas

Junction City.—Latitude 39° 02' N., longitude 96° 48' W.

Camp Funston; reported by the National Aircraft Underwriters Association; no data.

Lawrence.—Latitude 38° 58' N., longitude 95° 12' W.

Reported by the National Aircraft Underwriters Association; no data.

Kentucky

Barbourville.—Latitude 36° 51' N., longitude 83° 53' W.

Commercial field and flying school.

Lexington.—Latitude 38° 03' N., longitude 48° 30' W.

Race track field.

Louisiana

Houma.—Latitude 29° 35' N., longitude 90° 42' W.

Municipal field; on fair grounds and 16 acres adjoining.

Pineville.—Latitude 31° 20' N., longitude 92° 25' W.

Reported by the National Aircraft Underwriters Association; no data.

Welsh.—Latitude 30° 14' N., longitude 92° 47' W.

Emergency; rice farm, 500 by 1,500 feet; 1½ miles west of town between railroad and highway, near stream; 18 miles east of Lake Charles.

Maine

Auburn.—Latitude 44° 06' N., longitude 70° 15' W.

Northeast Aeroplane Co. Field; small.

Maryland

Cambridge.—Latitude 38° 35' N., longitude 76° 04' W.

Seaplanes only.

Chestertown.—Latitude 39° 12' N., longitude 76° 04' W.

Seaplanes only.

Crisfield.—Latitude 37° 59' N., longitude 75° 52' W.

Seaplanes only.

Easton.—Latitude 38° 46' N., longitude 76° 05' W.

Seaplanes only.

Ocean City.—Latitude 38° 20' N., longitude 75° 05' W.

Seaplanes only.

Oxford.—Latitude 38° 41' N., longitude 76° 11' W.

Seaplanes only.

Salisbury.—Latitude 38° 22' N., longitude 75° 36' W.

Seaplanes only.

Massachusetts

Auburn.—Latitude 42° 12' N., longitude 71° 49' W.

Emergency; 900 by 1,000 feet; stone wall south and east.

Cliftondale.—Latitude 42° 27' N., longitude 71° 01' W.

6 miles north of Boston, on race track. Land east and west on north track only.

Danvers.—Latitude 42° 34' N., longitude 70° 56' W.

Emergency; 30 acres, square; north of reservoir, along road.

Dorchester.—Latitude 42° 18' N., longitude 71° 03' W.

Franklin Field Playground; dangerous; 50 acres; near Boston; emergency only.

Greenfield.—Latitude 42° 37' N., longitude 72° 35' W.

The Meadows Field; ½ mile square; 3½ miles out along road; 2 miles from Deerfield.

Hingham.—Latitude 42° 14' N., longitude 70° 53' W.

Emergency field, 15 miles south of Boston; 1,800 by 700 feet.

Nantasket Beach.—Latitude 42° 17' N., longitude 70° 52' W.

Kenberma Park Field; L shaped, near beach; marked with circle; service and supplies by American Aerial Corporation of Boston.

North Beverly.—Latitude 42° 33' N., longitude 70° 53' W.

Emergency; 25 acres, southeast of reservoir; 3 miles out.

Revere.—Latitude 42° 24' N., longitude 71° 00' W.

Field of the Lynnway Aircraft Corporation; 30 acres; hangars and supplies; along the boulevard between Revere Beach and Lynn.

South Sudbury.—Latitude 42° 22' N., longitude 71° 27' W.

Field of American Aerial Corporation; 15 miles west of Boston; 25 acres, along highway at railroad crossing; marked by the letter A inside a circle; service and supplies.

Michigan

Alpena.—Latitude 45° 05' N., longitude 83° 27' W.

For seaplanes only; moorings not so good on account of town being on open lake; flying-boat anchor must be used; fuel ordered in advance.

Harbor Springs.—Latitude 45° 25' N., longitude 85° 00' W.

No data.

Holland.—Latitude 42° 48' N., longitude 86° 05' W.

Seaplanes only; good landing on lake; flying-boat anchor must be used.

Mackinaw.—Latitude 45° 45' N., longitude 84° 45' W.

Seaplanes only; mooring hazardous except in smooth weather.

Manistique.—Latitude 45° 58' N., longitude 86° 15' W.

Reported by the National Aircraft Underwriters Association; no data.

Manistee.—Latitude 44° 14' N., longitude 86° 22' W.

Seaplanes only; good in open lake if water is smooth; must be taxied between two breakwaters into small harbor; flying-boat anchor must be used.

Muskegon.—Latitude 43° 13' N., longitude 86° 15' W.

Seaplanes only; shallow water and rocks; mooring facilities good.

Petoskey.—Latitude 45° 22' N., longitude 84° 58' W.

Seaplanes only; flying boat can be tied to dock; anchor must be used.

Port Huron.—Latitude 42° 58' N., longitude 82° 24' W.

Seaplanes only; mooring facilities not good on account of current.

Saginaw.—Latitude 43° 28' N., longitude 83° 58' W.

Fair grounds; ½-mile track; 2 miles east of town; clear approach.

Traverse City.—Latitude 44° 45' N., longitude 85° 38' W.

Seaplanes only; city on open lake; weather must be watched.

Minnesota

Amboy.—Latitude 43° 53' N., longitude 94° 09' W.

Emergency; no data.

Hibbing.—Latitude 47° 28' N., longitude 92° 54' W.

Pritchard Field to south; ideal; to be used by forest patrol pilots.

White Bear Lake.—Latitude 45° 06' N., longitude 93° 00' W.

Harold Peterson Aircraft Co. Field.

Mississippi

Aberdeen.—Latitude 33° 47' N., longitude 88° 27' W.

Fair Grounds; in race track; emergency.

Laurel.—Latitude 31° 42' N., longitude 89° 02' W.

Municipal fair grounds; 830 by 310 feet, in ½-mile track; Madison Station.

Natchez.—Latitude 31° 34' N., longitude 91° 20' W.

Seaplanes only; landing facilities good; fuel ordered in advance.

Missouri

Bogard.—Latitude 39° 28' N., longitude 93° 30' W.

Emergency; no data.

Bridgeton.—Latitude 38° 45' N., longitude 90° 24' W.

Emergency; no data.

Clinton.—Latitude 38° 22' N., longitude 93° 46' W.

Owen Farm Field, 1 mile east long road, near cemetery; 40 acres; good when wet.

Ester.—Latitude 37° 51' N., longitude 90° 31' W.

Reported by the National Aircraft Underwriters Association; no data.

Mexico.—Latitude 39° 10' N., longitude 91° 53' W.

Old Fair Grounds Field; 100 acres, two miles southeast of town.

Moberly.—Latitude 39° 26' N., longitude 92° 27' W.

Emergency; no data.

St. Francis.—Latitude 37° 52' N., longitude 90° 32' W.

Emergency; no data.

Willow Springs.—Latitude 36° 59' N., longitude 91° 59' W.

Emergency; no data.

Montana

Bridger.—Latitude 45° 14' N., longitude 108° 57' W.

Curtiss-Montana Aeroplane Company Field, near race track, on runway, 1,800 feet square; soft if wet; hangar barn.

Butte.—Latitude 46° 00' N., longitude 112° 33' W.

Municipal; along stream between Railroad track and road; 80 acres; marked with T; ideal; service and supplies.

Forsyth.—Latitude 46° 14' N., longitude 106° 44' W.

Woolston Field, 2½ miles southeast along road; 600 by 5,000 feet; ideal; hangar and supplies.

Nebraska

Alliance.—Latitude 42° 06' N., longitude 102° 53' W.

Municipal; reddish field ¾ mile west of town; 50 acres; good when wet.

Bushnell.—Latitude 41° 14' N., longitude 103° 53' W.

Emergency field south of town.

Galloway.—Latitude 41° 17' N., longitude 99° 55' W.

Emergency field south of town.

Dunning.—Latitude 41° 50' N., longitude 100° 05' W.

Emergency field; ideal; east of town in fork of river.

Grand Island.—Latitude 40° 55' N., longitude 98° 20' W.

Grand Island Aero Field; 1½ miles east of town; 75 acres marked with T; good when wet; two hangars; altitude 1,700 feet.

Hastings.—Latitude 40° 35' N., longitude 98° 24' W.

College Camp Grounds; 25 acres, 1½ miles south; college buildings east.

Kearney.—Latitude 40° 42' N., longitude 99° 05' W.

Ranch field on Lincoln Highway; across white stone bridge over Platte River; near academy; hangar and supplies.

Lexington.—Latitude 40° 46' N., longitude 99° 44' W.

Ideal field along road, west of cemetery, 2,640 by 800 feet; good when wet.

Potter.—Latitude 41° 13' N., longitude 103° 19' W.

Emergency field about 1 mile west on north side of tracks.

Nevada

Parran.—Latitude 39° 48' N., longitude 118° 40' W.

No data.

New Jersey

Brookside.—Latitude 40° 47' N., longitude 74° 35' W.

Large unplowed field 58 miles from Mineola, on the railroad. Field of the Eagle Flying Corps; 1,800 feet square, 3 miles from town, east of railroad crossing; red hangar on west; good when wet; mine shaft northeast side; altitude 600 feet.

Elizabeth.—Latitude 40° 40' N., longitude 74° 14' W.

Emergency. No data.

Newport.—Latitude 39° 18' N., longitude 75° 10' W.

Reported by the National Aircraft Underwriters' Association; no data.

Port Murry.—Latitude 40° 47' N., longitude 74° 55' W.

67½ miles from Mineola; suitable for emergency landings; supplies.

Ridgewood.—Latitude 40° 58' N., longitude 74° 07' W.

Rouclere Field; commercial; passenger carrying.

Seagirt.—Latitude 40° 07' N., longitude 74° 02' W.

Camp Edwards Field; 5,000 by 2,000 feet, along ocean, between barracks and road; very good.

Spring Lake Beach.—Latitude 40° 10' N., longitude 74° 02' W.

Emergency; along coast and west of bridge crossing inlet; commercial.

Wrightstown.—Latitude 40° 02' N., longitude 74° 37' W.

Camp Dix, 15 miles southeast of Trenton; West Point Cadets in training; emergency.

New Mexico

Garcia Ranch.—Latitude N., longitude W. Near border monument No. 67; good field with 4-way approach.

New York

Alexandria Bay.—Latitude 44° 20' N., longitude 75° 55' W.

Seaplanes only; good landing facilities; use flying boat anchor.

Batavia.—Latitude 43° 00' N., longitude 78° 11' W.

Emergency only; fair grounds; poor.

Canton.—Latitude 44° 36' N., longitude 75° 10' W.

Fairgrounds; ½ mile track; good field. ½ mile northwest of town.

Cornwall-on-Hudson.—Latitude 41° 26' N., longitude 74° 00' W.

Military Academy Field; 500 by 100 yards; good when wet.

Geneseo.—Latitude 42° 48' N., longitude 77° 50' W.

Emergency field 1,500 by 1,800 feet, two miles north of town; good when wet.

Lake George.—Latitude 43° 26' N., longitude 73° 42' W.

Seaplanes only; excellent landing facilities; aeromarine *Santa Maria*.

Newburgh.—Latitude 41° 30' N., longitude 74° 00' W.

Seaplanes only; buoy placed in river by Chamber of Commerce.

Rye.—Latitude 40° 39' N., longitude 73° 41' W.

No data.

Tupper Lake.—Latitude 44° 13' N., longitude 74° 28' W.

Osley Farm Field; 500 by 1,500 feet; good, fenced, along road.

(To be concluded)

EXPERIMENTAL STUDY OF HABITUATION TO ROTATION

CAN you think of rats—such vermin as rats—serving any good end to aviation?

Science says, "Yes!"

Some of those men who delve into the nooks and crannies and by-paths of the unknown things of life—men whom we call Scientists—have been experimenting on rats in order to add to our knowledge. They have learned much about the most desirable foods for human beings, for instance, from such experiments. And from other kinds of tests already made on rats they have discovered a number of facts that relate to the science of flying. For two years Professor Madison Bentley has conducted elaborate experiments on rats in rotation for the purpose of studying the effect of an animal becoming accustomed to turning around completely on an axis. Rats have been born in this process of rotation. Among the things Professor Bentley has found out is that certain tendencies toward loss of origin through the car can be inherited. By orientation scientists mean the process by which direction is ascertained.

It is easy to recognize the value of such investigations as those concerned with the materials that go into the making of aircraft, the development of a reliable engine that will use a low grade fuel, or the determination of forces on an aeroplane, or of the interference effects of the structural members.

But few people realize that a small part of the inner ear has much to do with seasickness, and that this same portion of the ear effects the ability of a man to handle an aeroplane or airship.

Since the close of the war the National Research Council has had several projects centering on the studying of human factors in flying, involving behavioristic experiments on man and animals; anatomical, physiological and psychological studies of the functions of the ear and associated eye movements; the writing of a history; and the collection of a complete bibliography on the subject. Last year the workers in this field came together and

organized themselves into a committee on Vestibular Research for the purpose of encouraging and co-ordinating work in this field. This committee has formulated a project on "The Experimental Study of Habituation to Rotation," which has been approved by the National Research Council. This project forms a natural nucleus around which may be gathered data from field experience, clinical records of fliers, and facts from laboratory experiments bearing on the subject in such a way as to favor a critical analysis of the situation and lay the foundations for both theory and practice.

The project will be administered by an executive committee, at the present time composed of Dr. J. Gordon Wilson, Chairman, Dr. Raymond Dodge, and Dr. F. H. Pike, in co-operation with the Chairman of the Division of Biology and Agriculture, Medical Sciences and Anthropology and Psychology in the National Research Council.

Dr. Dodge has made himself the outstanding authority on the measurement of eye movements as influenced by orientation through the ear, and it is believed that under his direction there will open up a large field of practical work which can be done to great advantage with a newly designed instrument for use in the study of the balancing power of aviators by photographic methods. Dr. Pike has made valuable contribution to brain anatomy bearing on the relation of the sensory mechanisms in the labyrinth to the sensory mechanism of sight and touch, giving us a new point of view in regard to the function of the ear in conjunction with the visual and tactical sense of orientation in flying. This opens up an entirely new approach to the practical investigation of fitness for flying, and should be followed up both by anatomical studies and by practical tests on fliers. Other scientific men on the committee include Dr. Irving Hardy, who has undertaken to examine microscopically the Bentley rats, and to construct norms as a basis of comparison for future study of modifications in the air;

Dr. S. S. Maxwell, who has made notable contributions to the study of anatomical conditions of orientation through the ear by studies on the shovel-nosed ray and other animals, which present unusually favorable conditions for the investigations of these phenomena; Dr. George L. Streeter, who is engaged in embryological studies of the development of the ear with particular reference to the structural conditions for orientation in flying; Dr. Knight Dunlap, who has equipped a laboratory in Johns Hopkins University at great expense specifically for the investigation of the behavior of human beings under conditions involved in flying; Dr. J. Gordon Wilson, who is now conducting investigations on hearing and the anatomy of this function; Dr. Percy W. Cobb, who has been active on the practical side of the question; Dr. W. H. Wilmer, who did such active work during the war and has been instrumental in securing the cooperation of investigators with reference to the organization of investigations on actual flyers, and Drs. I. R. Jones, V. C. Vaughan, C. E. Seashore, Chairmen of the Divisions of Biology and Agriculture, Medical Sciences, and Anthropology and Psychology of the National Research Council. The last three are ex-officio members of the committee, Dr. Seashore being its chairman.

The air service of the army is giving its active cooperation to the investigator's through this special committee. Major Bane, Chief of the Engineering Division of the Air Service, has recently stated that a proper figure for research for experimentation in aeronautics would be ten million dollars annually. "There is no better economy than scientific research," he says. He has chiefly in mind of course research in machinery and materials, but what about the human in the aeroplane? The National Research Council is seeking to find some people who will be interested enough in this fundamental research as to favorable conditions in the aviator to provide not less than \$25,000 covering the research investigations of this committee during the period of two years.

NOTES ON PROPELLER DESIGN—II

The Distribution of Thrust Over a Propeller Blade

By MAX M. MUNK

Technical Note National Advisory Committee for Aeronautics

Summary

THE best distribution of the thrust over the length of the propeller blade is investigated, taking into account chiefly the slip stream loss and the friction between the blades and the air.

The energy losses of the propeller depend noticeably on the distribution of the thrust over the length of the blades, and the losses can be diminished by a favorable distribution. The two induced losses of smaller importance, the loss due to the finite number of blades and the loss due to the rotation of the slip stream, call for a gradual decrease of the thrust per unit of propeller disc area towards the inner and outer end of the blades. Near the center the thrust is naturally less dense, and hence the loss from rotation is generally kept reasonably small without special effort of the designer and no further improvement is here possible. The breadth of the blades, however, is not always tapered towards the tips as much as would be desirable in order to keep small the loss due to the finite number of blades. It is true, the actual thrust distribution is almost as favorable in spite of it and the density of thrust always decreases properly, because it is physically impossible for a wing to produce a finite density of lift quite close to its end. Still the wing works then under less favorable conditions and with smaller efficiency, and the weight of the propeller and the centrifugal force is unnecessarily great too. Now, the following investigation will show that a gradual decrease of the density of thrust towards the ends is also desirable for other reasons. It is sufficient therefore to keep in mind that the wing tips have to be round, and to consider in the following investigation only the two chief energy losses, the energy absorbed by the air friction and the slip stream loss.

A small variation of the distribution of the thrust hardly changes noticeably the entire loss, especially if the distribution is already close to the best distribution. Hence the problem is less the exact determination of the best distribution of thrust than the derivation of a simple expression which gives quickly an idea as to how the thrust has to be arranged.

The conditions are quite different from those for ordinary wings. There, the inductive losses form a much greater part of the entire losses, and the other part, that is the loss of friction, does not depend on the distribution of the lift at all. Hence, with ordinary wings the distribution of the lift is determined by the consideration of the induced drag exclusively. With the propeller, however, the friction is the dominant part, and both, not only the slip stream loss but the loss of friction too, depend on the distribution of the thrust, for the velocity of the blade elements relative to the air is variable and greater at greater distance from the axis. And whether the ratio lift/drag be constant or not, the ratio of the useful work done by the lift to the energy absorbed by the drag is quite different from it and certainly not constant in general. The useful work is done in the direction of the constant velocity of flight, but the friction is multiplied by the relative velocity of the blade element and the loss is the smaller the smaller the relative velocity is. Therefore the consideration of the friction alone calls for a great density of the thrust near the center. The slip stream loss alone however calls for constant density of the thrust. Hence the smallest loss occurs at a compromise, that is, that the thrust is neither concentrated near the center nor distributed uniformly, but that the density of thrust decreases uniformly towards the outside.

A short calculation will be sufficient to give numerical information on the desirable decrease. Let C_p denote the density of the thrust per unit of the disc area divided by the dynamical pressure of the velocity of flight, that is

$$C_p = \frac{dT}{V^2 \rho df} \cdot \frac{1}{2}$$

where dT denotes the infinitesimal thrust acting on the small area df of the propeller disc. C_p may be assumed to be small, say up to .50. Then the slip stream loss originated by this thrust is approximately $\frac{1}{4} C_p$ multiplied by the useful work done by the same element of thrust. The density of drag measured in the same way is C_D/C_L and the work absorbed by this drag is $C_D/C_L v/V$ times the useful work, where v denotes the velocity of the blade element relative to the air and V the velocity of flight. For simplicity's sake, I will re-

place the velocity v by the tangential velocity of the blade element, which is somewhat smaller but not so much that it will greatly injure the final result.

The problem can now be stated in the following way. Let r denote the radius of the blade element, that is, its distance from the axis. The entire thrust is easily found to be

$$(1) \quad T = 2 \pi q \int_0^{D/2} C_p r dr$$

The slip stream loss for the path of length 1 of the aeroplane can be taken as

$$(2) \quad 2 \pi q \frac{1}{4} \int_0^{D/2} C_p^2 r dr$$

The energy absorbed by the friction during the same time is

$$(3) \quad \frac{(2 \pi)^2 q n}{V} \int_0^{D/2} \frac{C_D}{C_L} C_p r^2 dr$$

The Coefficient of thrust density C_p variable along the length of the blade, is to be determined in such a way that for a given thrust (1) the sum of the two losses (2) and (3) becomes a minimum.

The solution is extremely easy. It can be seen that by transferring an element of thrust from one place to another the entire loss must not be changed, nor the entire thrust, and hence the ratio of the local change of loss to the change of thrust must be equal to a constant, say λ . The equation which determines the desired function is therefore

$$\delta (\lambda (1) + (2) + (3)) = 0$$

where δ means that the variation originated by any variation of C_p as to form. That is the same condition as if

$$2 \pi q \int_0^{D/2} \left[\frac{1}{4} C_p^2 r + \frac{2 \pi n}{V} \frac{C_D}{C_L} C_p r^2 + \lambda C_p r \right] dr$$

is to be made a minimum. The variation is proportional to the integral over

$$\frac{1}{2} C_p r + \frac{2 \pi n}{V} \frac{C_D}{C_L} r^2 + \lambda r = 0$$

which then has to be zero at every point r . Hence the solution of the problem is

$$(4) \quad C_p = 2 \lambda - 4 \frac{\pi n}{V} \frac{C_D}{C_L} r$$

It shows, as was to be expected, that the thrust density has to be constant only if the drag coefficient of friction $C_D = 0$. But if the friction is taken into account, it is not constant but has to decrease towards the outside. The simplifying assumptions make it appear as a linear function of the radius, and that is just what we wanted, and exactly enough. It remains only to determine the value of the constant from the condition that the entire thrust has a particular value in order to obtain the final expression for the density of thrust. By substituting equation (4) in equation (1) it appears that

$$T = 2 \pi q \int_0^{D/2} \left(2 \lambda - \frac{4 \pi n}{V} \frac{C_D}{C_L} r \right) r dr$$

$$\text{i. e.,} \quad T = 2 \pi q \lambda \frac{D^3}{4} - \pi q \frac{\pi n}{4} \frac{C_D}{C_L} \frac{D^4}{V}$$

$$\text{Hence} \quad 2 \lambda = \frac{T}{D^2 \pi q} \cdot \frac{4}{3} \frac{C_L}{C_D} \frac{\pi n D}{V}$$

and finally,

$$C_p = \frac{T}{D^2 \pi q} + \frac{4}{3} \frac{C_D}{C_L} \frac{\pi n D}{V} - 2 \frac{C_D}{C_L} \frac{\pi n \cdot 2r}{V}$$

At a radius 2-3 of the greatest radius, the thrust has the mean density, the same that it had to have without friction. At the blade tips, the density has to be

$$(5) \quad \frac{T}{D} = \frac{2}{3} \frac{C_D \pi n D}{C_L V}$$

$$D = \frac{\pi}{4} q$$

This expression can become negative. But then one essential assumption for the proceeding is no longer valid C_L/C_D is no longer constant but changes its sign. For this reason a negative thrust appears uneconomical in accordance with what everybody expects. Equation (5) becoming negative rather indicates that the diameter has reached its most economical value. This appears, then, to be

$$D^3 = \frac{T V}{n q} \frac{C_L}{C_D} \frac{6}{\pi^2}$$

Let us see now by means of an example, what the derived formulas give for usual conditions. They will give different results for the same propeller under different conditions of flight a reason more why to confine the calculation to a moderate exactness conveniently to obtain.

Illustration:

Diameter 9 ft., that is, disc area 63.5 sq. ft.
 n 25 revolutions per second, that is n D = 706 ft/sec.
 Thrust 400 lbs.
 V 100 mi/hr.
 C_L/C_D 22
 q 25 lbs/sq. ft. dynamical pressure of flight.
 $400 \cdot 100 \cdot 1.47 \cdot 22.6$
 $D^3 = \frac{25 \cdot 25 \pi^2}{25 \cdot 25 \pi^2} = 1260 \text{ ft}^3$
 $D = 10.6 \text{ ft.}$

That is pretty near to the actual diameter. However, the conditions of great velocity are favorable for a small economical diameter. Suppose on the other hand the velocity of the same propeller to be 60 mi/hr. only and the thrust to be 575 lbs. The dynamical pressure q may be 10 lbs/sq. ft.

Now,

$$D^3 = \frac{575 \cdot 60 \cdot 1.47 \cdot 22.6}{10 \cdot 25 \pi^2} = 2700 \text{ ft}^3$$

$$D = 14 \text{ ft.}$$

Even in this case, the diameter results only 14 ft., which indicates that the improvement theoretically possible cannot be exceedingly great.

In the first case the mean value of C_p appears .252 and C_p at the blade tip has to be .106. The mean value agrees with the desired value at 2/3 of the radius as always. That is a rather great variability, which corresponds to the fact that the diameter is only slightly smaller than the most economical diameter. In the second example, the mean value of C_p is .90. This is comparatively high and in consequence of it the developed formulas give too large a diameter, for the factor .25 for the induced loss is too high for large values of C_p . Paying no attention to this, the coefficient at the blade tips appears .658. The density is much more constant now, according to the greater predominance of the slip stream loss.

The results obtained are only approximate. The formula for the diameter is not to be considered as a literal prescription. The weight of the propeller is not considered nor the resulting tip velocity, which cannot be increased without limit. Besides, the diameter is more often determined by the general lay-out of the aeroplane. The formula is only to show whether an increase of the diameter means an improvement at all, and to give an indication how much.

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The stated monthly meeting of the Club was held at the Engineers' Club on the evening of April 24th. It is a source of much gratification to note that the meetings are being more largely attended than ever in the history of the organization. This is undoubtedly due to the excellent program of the meetings and the interesting lectures which the committee on entertainment provide.

Mr. H. L. Goehde, Managing Director of the Municipal Exposition, gave an interesting talk on the Aero Meet which he is planning for Philadelphia, to be held the latter part of May. Liberal prizes and trophies for the events will be offered and if the response is sufficient to guarantee the meet same will be held under the auspices of the Aero Club of Pennsylvania, the officials of which will act as judges for the races and contests.

Mr. Stephen H. Noyes, of the city Bureau of Surveys addressed the meeting on the subject of Municipal Landing Fields and invited the views of the members as to location and proper size of same. Mr. Noyes secured a great deal of data which he proposed to submit to City Council and it is felt that very soon Philadelphia will fall in line with the other progressive cities which have visioned the future and provided air ports for the winged ships of the air.

In connection with the above, the Club

is in receipt of blue prints and photographs from the Department of Commerce, Bureau of Standards, Washington, in which Mr. Arthur Halstead, Chairman of Subcommittee on Airdromes and Traffic Rules, invites the Club to submit their comments and criticism of the sizes, markings and dimension of the fields as arrived at by the subcommittee on March 10th.

President Steinmetz has written, in the name of the Club to fully a dozen or more senators. Making an earnest appeal to their patriotic spirit to support the budget for Aviation Research with particular reference to the opportunities of the McCook Field for the reason that aviation research work is the essential working out of commercial aeroplane safety. The letter is a prayer that the appropriation agreement of \$3,250,000 for the fiscal year 1922-23 shall stand without any reduction.

Lieutenant Ralph M. Haynes, who served with the British in the World War and who is known as a stunt flier, claims he has established a world's record for tail spinning, as the result of a flight at the Bergdoll Field, Manoa, Pa., on April 24th.

He fell between 9,500 and 9,700 feet in the tail spin. It is claimed the best previous record is 8,500 feet, made at Daytona Beach, Fla., last fall. Haynes carried A. O. Gillette with him as an observer. Gillette is also a stunt flier. They took the plane up to an altitude of 11,500 feet, but

could not ascend further because the pump froze. They dropped from that level and righted the plane without difficulty about 2,000 feet from the ground.

The regular monthly meeting for April was held at the Engineers' Club on the evening of April 26th. The members of the Club were thus given the opportunity of a joint session with the Society of American Military Engineers. The speaker of the evening was Major P. E. Van Nostrand of the Training and War Plan Division of the Army Air Service and the topic of the lecture was "Airships and Helium Gas."

The many lantern slides and motion pictures with which the lecture was illustrated were highly interesting and instructive.

It was announced that the Army Air Service is soon to take a series of photographs of Philadelphia and surrounding territory, in co-operation with the joint committee of the Chamber of Commerce and Aero Club of Pennsylvania, for the purpose of a selection of Air Fields for the Sesqui-Centennial of 1926.

The Aero Club of America has appointed Major Charles J. Biddle, Mr. Wallace Kellett and President Steinmetz of the Club as representatives to attend the session of the Academy of Political and Social Science meeting in Philadelphia, May 12th and 13th.

W. H. SHEAHAN,
1st Vice-President.

THE VERSATILE AEROPLANE

A great deal has already been written about the versatility of the aeroplane, both in time of war and in time of peace. As an instrument of warfare the aeroplane is a most potent force. The great World War has amply demonstrated this, and the contention that aircraft serve as a first line of offense or defense was proven beyond question during the maneuvers last year at Langley Field, Va., when a number of modern type warships were sent to their watery graves as a result of the accuracy of our airmen had acquired in dropping high explosive bombs. As a peace time utility, however, the possibilities of the aeroplane are without limit. Many uses have already been found for it, aside from its principal uses as a means of rapid transportation.

The aeroplane is an engine of destruction in time of war, but it appears to be just the reverse in time of peace. The world is just beginning to realize what a great boon to mankind it really is. For the past several years the Army Air Service has been co-operating with the Forestry Service in an endeavor to suppress the great number of forest fires occurring annually in the vast forested areas of our Great Northwest and in California. Using aeroplanes as a means of patrolling these forests, the observers were able to discover fires practically at their inception, and the prompt reporting of same by radio to headquarters enabled the fire fighters to institute prompt measures to combat them. Thus, the aeroplane has played a most prominent part in conserving the timber resources of the country, and has thereby saved the government vast sums of money.

Fire, however, is not the only destructive force that continually threatens the existence of our forests and orchards. The insect pest is also a power to be reckoned with. Last summer a grove of Catalpa trees near Troy, Ohio, was practically defoliated by the ravages of caterpillars. Here, again, the aeroplane came to the rescue. Flying over this grove and spilling arsenate of lead powder from a hopper attached to the side of the fuselage, the aeroplane accomplished in one minute what could hardly have been accomplished with twenty of the most powerful liquid spraying machines. And the experiment was a pronounced success, the official report on same stating that practically all the insects were exterminated.

The sealing industry, heretofore a rather fluctuating, hit-or-miss sort of a business, and which, for this reason, has been steadily and persistently declining for several past decades, bids fair to recuperate under the ministrations of "Doctor Aeroplane." By reason of the fact that here was no system of intelligence to guide the sealing fleet in its movements, there was always a likelihood that during the night an ice floe carrying the main herd of seals would drift silently by

a few miles away and be far over the horizon before the sealers realized the unkind trick Dame Nature played upon them. The occasions upon which the main herd have been missed in this manner have been numerous, and under such circumstances the disappointed sealers were forced to rest content with such crumbs in the form of detached masses of ice carrying a few seals as happened to come their way. The coming of the seal aeroplane has changed all this. Seeking for seal-laden drift ice and maintaining constant wireless communication with the sealing fleet is identical with the spying out of the countryside for the movement of troops in war. The reliability of the flying machine, combined with its radius of action, has rendered it indispensable to the industry.

Out on the Pacific Coast fishermen have utilized the aeroplane in locating schools of fish and leading the boats to large hauls.

As regards the subject of surveying and map making, the aeroplane has already established itself as a practical means of securing quickly, cheaply and accurately, information which can be put to a wide variety of uses in engineering practice. Added to this is the ability of the aeroplane to cover territory inaccessible on foot. Aeroplane photography offers extremely interesting possibilities.

And now we come to a subject that intimately concerns the farmer. Last summer the Bureau of Plant Industry, Department of Agriculture, conducted in a very limited way experiments along the line of collecting from the upper air certain parasites which have been causing different plant diseases. The results they have achieved justify their opinion that a great deal can be learned from a study of the different spores which can thus be collected. The most destruction of this fungi is the black stem rust of wheat, oats, barley, rye and many grasses. An idea of the destructiveness of this parasite may be gained from the fact that in 1916 it caused the destruction of over 200,000,000 bushels of wheat in the United States and Canada—not a very pleasant thing to contemplate either by the farmer or the consumer. It is known that this parasite survives the winter in the north on the common barberry bush which has been used so extensively for hedges. Steps have therefore been taken to eradicate this particular plant on this account. The theory is advanced that these spores are developed in the south and are carried north into the wheat regions by the air currents. Dr. Stakman of the Bureau of Plant Industry, Department of Agriculture, under the direct supervision of Dr. Kellermann, Associate Chief of the Bureau of Plant Industry, in co-operation with representatives of the Engineering Division at McCook Field, Dayton, Ohio, is conducting certain experiments in this connection, and there is now being designed

an efficient type of spore trap which will contain several common laboratory slides, the faces of which slides will be covered with a gelatinous matter or vaseline. These spore traps will be placed on aeroplanes and will be so arranged that different slides may be exposed at different elevations in the air. It is anticipated that the air blowing against these slides will result in there being collected on them whatever fungi there may be present in the air in that particular region. A simple laboratory test will serve to identify the various classes of fungi spores which may be collected.

Representatives of the Department of Agriculture will conduct these tests during the spring and summer at Kelly Field, San Antonio, Texas; Chanute Field, Rantoul, Ill.; Fort Riley, Kansas; Post Field, Fort Sill, Okla.; and Camp Knox, Ky. These spore traps will be installed on a great number of aeroplanes during the course of their numerous flights, and a careful record will be kept of the results obtained. At the end of the season a compilation of the results will enable the Bureau of Plant Industry in Washington to arrive at some definite conclusion in regard to this plant disease, and the Department of Agriculture may then be able to devise the necessary measures to combat, if not entirely eradicate, this highly destructive plant disease.

Just recently aeroplane pilots from Carlstrom Field, Arcadia, Fla., co-operated with the well known scientist, Dr. David Todd, Professor of Astronomy and Navigation, in a rather interesting experiment at Miami, Fla. Moving pictures were taken of the sun from an aeroplane at altitudes of 16,000 and 17,000 feet. The idea of taking the pictures from such altitudes was to get away from the dust particles in the atmosphere near the earth's surface. Professor Todd expects to gather some very interesting data from these films.

The other day the Netherlands Aircraft Mfg. Co. sent us a communication stating that it is reported from Holland that exceptionally severe weather would have imposed great hardships upon the inhabitants of the many islands which lie to the north of the Dutch mainland were it not for the timely assistance rendered by the big Fokker aeroplanes of the Royal Dutch Air Service Company. All boat traffic having ceased owing to the ice, the aeroplanes were used to deliver large quantities of food and other supplies to the islands.

The foregoing enumerates only a few of the many uses which have been made of the aeroplane, which can be truly classed as the most wonderful invention of the age. Can anyone stretch his imagination far enough to say to what further use the versatile aeroplane will be put in the near future? Certainly, the aeroplane has come to stay, but it deserves far greater recognition and much better treatment than that which has so far been accorded it.

AEROPLANES USED IN EXPERIMENTAL WORK IN THE STUDY OF RUST SPORES

E. H. Ostrom, field assistant in cereal investigation of the U. S. department of agriculture, has arrived in Lawton, Okla., for the purpose of conducting a series of experiments requiring the use of aeroplanes. Mr. Ostrom is a graduate of the College of Agriculture of the University of Minnesota.

The war department is cooperating with the department of agriculture in these ex-

periments and in the work which he plans in this vicinity Mr. Ostrom is receiving co-operation from Post Field officials.

Mr. Ostrom explains the nature of the experiments, which will be of incalculable value to agriculturists, in the following:

"As long as 200 years ago plant diseases have been traced from their source for a distance of several miles. It is therefore an established fact that plant diseases

travel from one field to another carried by the wind, also that diseases which show up in some small area of the county in time spread so as to cover the whole of that county.

"It is also considered probable that it may travel to adjoining states or even further, but definite data is lacking.

"The black stem rust and other rusts are fungi, a form of plant life, very much re-



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The plant has employed during the past year an average of 450 people, which includes a complete Engineering Department and Experimental Shop.

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sembling bread mould. The reproductive units, which correspond to seeds of plants, are known as spores. These spores are too small to be seen with the naked eye, but when grouped together by the thousands as they are found on the wheat plant, they are visible as a pustule of rust.

"When the rust matures the spores are blown off and picked up by the wind and carried to other fields, thus spreading the disease. They alight on the growing grain, germinate and get inside the plant tissues, growing and branching so as to form a good root system; then as soon as weather conditions are favorable for the development of the disease, they grow rapidly, mature and burst through the epidermis, and we have rust on the plant.

"Lice do not have good pickings on a starving dog. Neither does the rust thrive on a drought-stricken wheat plant. When the wheat plant is growing most vigorously, when the sap is rushing up to nourish and fill the wheat head, then the rust develops most rapidly, sucking the sap which should fill the head. The result is light bundles, low yield and shriveled kernels.

"The black stem rust presents a problem. To fight it we must know definitely how and when it travels. In the states north of Kansas, Missouri and Tennessee, the common or Barberry bush rusts early in the

spring and spreads the black rust in its own territory. Barberry bushes do not rust in the south. In Texas and Mexico, the rust lives over winter on the winter wheat and on grasses, and the prevailing winds spread it around.

"The Daily Oklahoman on Monday, April 24, contains an article which creates the impression that army planes are to be used in spraying or dusting the wheat fields. This is incorrect, for there is no such intention.

"What we want is to determine how high the spores are carried upwards and at what altitudes they are most abundant; to learn at what time they appear in the air in different parts of the country; to find out the reaction of the spores to temperature, humidity, precipitation, ascending and descending air currents, velocity and direction of prevailing winds and any other meteorological data which may become available.

"Spore traps have been designed to catch these spores on glass slides coated with a thin layer of vaseline to which they stick.

"One or more altitude flights are planned during which a standardized thermometer will be used to record the temperatures at the various altitudes at which the exposures are made.

"Major Lohman, assistant commandant of Post Field, in explaining the wholehearted interest of the air service in these experiments said: 'You have my permission to fly from 8 a. m. to 4 p.m. every day in the week.' This gives me the opportunity to choose the most desirable time for each flight.

"Cross-country flights will be made to such cities as Liberal, Kan., Denver, Colo., Lincoln, Neb., St. Louis, Mo., Dallas, Tex., etc. Slides are to be exposed at points separated about 50 to 100 miles along the route, as well as at each of the destinations. This, then, permits of a fairly representative area being covered.

"After exposure these slides will be sent to the Minnesota Agricultural Experiment station for examination. Messrs. Christensen and Lambert, pathologists, at Minnesota, are to make the spore counts and will also make attempts to germinate the spores.

"Mr. G. C. Curran, state leader for Barberry eradication work in Illinois, will make flights from Chanute Field, and Wallace Butler, botanist at San Antonio, from Kelly Field.

"Dr. E. C. Stakman, chief of the division of plant pathology at Minnesota, is the guiding genius for the whole work."

Back Pay for Former Flying Cadet Awarded

The Court of Claims of the United States made a decision on February 27, 1922, stating that Nelson W. Rider, formerly flying cadet, United States Army, was entitled to \$306.82 back pay, incurred when the pay of flying cadets was cut from \$100 per month with 50 percent increase for flight duty to \$33 per month plus 50 percent thereon for flight duty. This cut was made about the first of July, 1918.

Following is an extract from the decision of the Court of Claims: "The Government contends that the provision of the act of June 15, 1917, which established the pay of the plaintiff at \$100 per month expired with the expiration of the appropriations set forth in the act. We are of the opinion that this contention is not tenable because of the provisions of the act of July 24, 1917, and of the act of July 9, 1918, which latter act makes available the appropriations of the act of July 24, 1917, and of the appropriations of the act of May 12, 1917, until June 30, 1919. Nor does it anywhere appear that there was any intention to repeal the provisions fixing the pay of enlisted men in training for officers of the Reserve Corps. It is hardly possible to conceive that Congress would at the height of the emergency, while the war was going on, reduce the pay which had been held forth as an inducement to the young men of the country to enter into training for officers in the Reserve Corps."

The Government has 90 days from February 27, 1922, in which to make an appeal. If this is not done within the allotted time, the decision holds.

AERIAL AGE has received several inquiries as to whether it will be necessary to file suit against the Government and obtain the services of an attorney to get back pay. This is not necessary. Former flying cadets should file their claims with the Comptroller General, War Department, Washington, D. C., and if the decision is upheld they should receive back pay due them.

Reserve Corps Activities in Oklahoma

Prior to the arrival of an Air Service officer, for duty with the 95th Division, U. S. Army, the headquarters of which is Oklahoma City, Major J. C. King, Cavalry, A. C. of S. (G-1), began the organization of the 320th Squadron (Observation) 95th Division. At the present

time Captain Louis D. Abney, A. S., O. R. C., Oklahoma City, the senior officer of the squadron, is due for promotion, and will, by virtue of his rank and experience, command the squadron.

In order to get the "right man in the right place" in the squadron, the Air Service officer with the Division is getting from all listed Air Service Reserve officers in his territory a tabulated statement of their air experience. It was found that this information was not definite enough under the heading "Chronological Statement of Military Service" on the reserve officers' qualification cards.

The headquarters of the Air Service of the 95th Division is at Muskogee, where the Air Service officer with the Division (now at Oklahoma City) will be located after April 1st. The headquarters of the 320th Squadron is at Oklahoma City.

It may be of interest to set forth the allocation of Air Service units to the State of Oklahoma:

The first priority for organization in the State of Oklahoma is:

Division Troops
95th Division, A. S. Hqrs. Muskogee
320th Squadron (Obs.) Oklahoma City
320th Photo Section. Tulsa
Branch Intelligence Office, A. S., 95th Div., not allocated.

Second Priority:
Army Troops, III Field Army
321st Air Service Attack Group, Hqrs., Enid
472nd Air Service Attack Squadron, Enid
473rd Air Service Attack Squadron, Enid
474th Air Service Attack Squadron, Enid
350th Air Park Enid
431st Photo Section. Enid

Third Priority:
XVIIIth Corps Troops—VI Field Army.
365th Squadron (Obs.) Tulsa
365th Photo Section. Oklahoma City
329th Balloon Company. Oklahoma City
108th Communications Section Oklahoma City

As soon as the Division Air Service is completely organized and capable of functioning in case of mobilization for an emergency, the second priority organization, and then the third will be started.

Outside of the regular Air Service garrison at Post Field, there are no other Federal Air Service activities in the State beyond what has been above mentioned.

The Aviation Committee of the Chamber of Commerce of Oklahoma City is a wide-awake organization. They are ac-

tively on the lookout for better airdrome facilities than now possessed at Needham Field. They realize the great future of aviation and are anxious to have Oklahoma City on the air map.

This same committee is forming the nucleus of a National Guard Squadron for the State, with the idea that they may get flying training, which they must have before being eligible for appointment as Reserve Officers.

Development of Model Airway

Under instructions recently received from the Chief of Air Service, First Lieutenant Clarence E. Crumrine, A. S. has been detailed on duty to investigate the route of the Model Airway from Mitchel Field, L. I., New York, to Pin Valley Field, N. J. This work includes the making of standard sketches and the completion of questionnaires on all intermediate fields, together with the taking of oblique photographs. These fields and following points are being investigated, sketched and photographed:

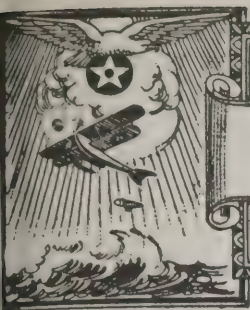
Valley Stream, L. I.; Belmont Park, L. I.; Sheepshead Bay, New Dorp, Staten Island; Freehold, New Jersey; Prospect town, New Jersey; Camp Dix, New Jersey; Medford, New Jersey; Sandy Hook, New Jersey.

Work on the development of this air route has already begun. It has been delayed due to inclement weather but will be now pushed to rapid completion.

Progress of the Air Service Mechanics School

The Air Service Mechanics School at Chanute Field, Rantoul, Ill., is functioning in every department. There are now 496 students actually undergoing instruction, and 225 awaiting instruction. The first class of men who were enlisted in the recent recruiting campaign will be graduated on May 12, 1922. It will consist of twelve armorers. Following this comes a class of five blacksmiths, who will complete the course on May 26th, and the following classes on June 9, 1922. Armorers, 12; fabric workers, 4; mechanics, airplane, 13; mechanics, airplane engine, 14; mechanics, auto, 14; machinists, 5.

The next class will graduate on June 26, 1922 and classes will follow throughout the year at periods of two weeks.



NAVAL *and* MILITARY AERONAUTICS



Night Flying in the Philippines

Lieut. R. Baez, Jr., gave the garrison at Clark Field, Pampanga, P. I., and not a few visitors, a thrill on Friday night, February 17th, when he made a night flight for the purpose of testing out the new flood lights recently installed on the hangars for emergency use. Lieut. Baez remained in the air for an hour, during which time he flew over the encampment of troops located several miles northeast of the field and Camp Stotsenburg proper. A perfect landing was effected, but due to the rough field a shock absorber was broken, without mishap, however.

Agricultural Experiments at Kelly Field

Prof. J. G. Butler, of the Department of Agriculture, made flights on March 7th and April 1st, from Kelly Field, with Lieut. F. P. Booker as pilot, in connection with some experiments he is conducting with a view to determining the origin of the spore of wheat rust in this country. The flight on March 27th was made in a DH4-B and the one on April 1st in a JN6H. It is the belief of the officials of the Agricultural Department that the spore of this parasite travels in the upper air from Mexico, and possibly Central and South America. Plates with mucus substance on one side are mounted on a rack on the wing, and by shutter arrangement are exposed from a control at the rear seat, whenever desired. Exposures were made at every 500 feet up to 3,500 feet with much success. In this experiment the JN6H was more satisfactory than the DH4B, the air stream of which prevented the shutters from closing gain.

Aviation Activities in Massachusetts

There is every likelihood that a landing field will be established in the City of Boston, if the efforts of a progressive organization like the 101st Aero Squadron, Massachusetts National Guard, count for anything. This squadron was federally recognized November 18, 1921, and was expected for permanent federal recognition March 3, 1922. Rooms have been assigned to house the squadron at the South Armory, Boston, and a drill period is held there every Friday night from 3:30 to 9:30 p. m. Some of the officers and non-coms give Monday evenings to squadron affairs, and spend other time at the armory also. Of the commissioned personnel of the squadron, the following have been assigned regular duties: Major Charles H. Colley, Commanding Officer; 2nd Lt. E. Boutwell, Adjutant and Supply Officer; 2nd Lt. H. N. Carlson, Engineer Officer and Officer in Charge of Instruction. The strength of the squadron on April 1 was 12 officers and 67 enlisted men. The officers enumerated above are the only ones so far assigned to special duties. Non-commissioned officers have been appointed to act as such until June 1st, when examinations will be held for permanent appointments. Under the direction of Lieut. Carlson, the schedule of instruction has been prepared and closely followed. Assembly is at 8

p. m. About half of each period is given over to basic training, such as infantry drill on the armory floor. The remainder is devoted to technical training. The enlisted men have been divided into sections for technical training, each section pursuing its assigned specialty of rigging, engines, ordnance, etc. Usually, on alternate Fridays the sections meet as a whole for a group lecture, the squadron being especially fortunate in having secured the voluntary services of Prof. E. P. Warner, of the Dept. of Aeronautical Engineering, Massachusetts Institute of Technology, who is delivering regularly a series of lectures to them.

Aside from uniforms, office furniture, and a few items of school equipment, the organization is still unequipped to function as a squadron. Its requisitions for flying equipment may be approved, but deliveries must wait until the State provides an aerodrome. Until then the flying activities of the squadron will be confined to occasional hops by some of the officers in planes of the A. S. Detachment of Framingham.

The problem of securing a landing field and suitable housing facilities for its equipment is the chief concern of the squadron today. It has combined efforts with the Corps Area Headquarters, the Chamber of Commerce of Boston, and the various aero clubs and interested individuals who are behind a bill now before the State Legislature which provides for the construction of a municipal landing field in East Boston which is to be leased for a ten year period to the Federal government for a nominal rental, the field to be used jointly by military and civilian planes, though under Federal supervision. The bill specifies an expenditure by the State of \$35,000.00 to level and prepare the runways. Ground adjacent to that leased to the Army is to be leased to civilian and commercial fliers for hangars and shops, and it is hoped that the establishment of this field will lead to the extension of the transcontinental Air Mail service from New York to Boston. The proposed field is within two miles of the Boston Post Office. This East Boston site has exceptionally favorable characteristics for a municipal aerodrome from the standpoint of convenience of location, freedom on all sides from obstructions, availability (the whole property is state-owned and at present is lying idle,) and its conspicuous position in the harbor making it easy to locate from the air. In addition, being surrounded on three sides by water, it will be available for seaplanes.

The landing field bill has been favorably reported by the Committee on Public Lands. It is now before the Joint Committee of Ways and Means. One hearing has been held. The latest advice concerning its progress in this Committee is to the effect that they are waiting for a definite proposal from the War Department stating exactly what the Army will furnish this aerodrome in the event that the bill is passed, and exactly what the cost will be to install and maintain hangars and shops, etc., for the National Guard. When the Committee receives more definite figures concerning the State's share of the expense, it will undoubtedly come to a

decision on the bill. The present indications are against an early report in favor of the bill should the Committee find out that the State will have to spend much more than the \$35,000 first asked for to be spent on the runways.

With regard to the social activities of the squadron, the Aero Club of Massachusetts gave a ball on February 24th, and donated half of the proceeds to the squadron fund. This donation amounted to \$638.26, and some contributions by the officers added to this has given the squadron fund a good start. This fund has been tapped to pay for coffee mugs, books, extra clerical work, and small administrative expenses. It is expected that the splendid interest and morale so far manifested by the personnel will increase with the approach of summer weather and lead to more social activities such as help to weld the organization into a "regular" body fostering good fellowship and loyal pride in themselves and in the army.

Athletics of some sort, including a baseball team, are contemplated for early inauguration.

Airplane Formation Greets New Department Commander

In preparation for the arrival of the new Philippine Department Commander, Major W. M. Wright, who sailed from the States on the Transport *Thomas*, arrangements were made for an eleven-plane formation to escort the *Thomas* to her dock. Five planes were flown to Paranaque Beach, Manila, on the morning of March 3rd, the pilots of these planes being flown back to Clark Field in the afternoon by pilots from Camp Nichols. At 6:45 a. m., March 6th, a five-plane formation took off from Clark Field and flew to Manila Bay, where they were joined by the formation from Paranaque Beach. They flew to meet the *Thomas* and escorted her to the pier.

A Bombing Record at Aberdeen, Md.

The best bombing record for the Aberdeen Proving Grounds, Md., was made on April 6th, when, with First Lieut. Max F. Moyer, A. S., and Master Sergeant William F. Fitch, Air Service, as pilots, and Captain S. R. Stribbling, Ordnance Department, as bomber, a total of seven hits out of eight bombs dropped was recorded. The bombs were dropped from an altitude of 2,000 feet on the "Hard Surface," a concrete block, 200 feet by 200 feet. The eighth bomb missed the target by approximately two feet. During the week ending April 8th a total of 2,600 pounds of bombs were dropped from the Airship C-2 on the "Hard Surface".

Test of Sperry Gyro Compass

A special flight was made at the Aberdeen Proving Grounds on April 3rd with a Sperry Gyro compass. With Mr. J. A. Fitz, of the Sperry Company, conducting the test on the compass, a triangular course was flown from Aberdeen to Belair, to Havre de Grace and return to Aberdeen. The performance of the compass on this short run was very satisfactory.



FOREIGN NEWS



French Air Mail

In connection with the report on French commercial aviation activities published in Commerce Reports of January 23, 1922, recent figures are interesting as showing a considerable increase in the use of the aerial postal service between Toulouse and Casablanca. During October, 1921, 40,600 letters, weighing 1,560 lbs., were carried between the points named as against 24,850, weighing 870 lbs., in October, 1920. A saving of five days in transmission of mail accounts for the popularity of the air route. During the year ending September 30, 1921, the mail matter carried by this service consisted of 306,181 pieces out of a total of 351,742 pieces carried by all aerial routes between France and foreign countries. Of the figures given, the Paris-London service transported 28,534 pieces, the remainder being carried by the services from Paris to Brussels, Amsterdam, Prague and Warsaw.

Egyptian Air Mail

The aerial mail route established between Cairo and Bagdad has been extended to include Palestine. A regular fortnightly service will be maintained in each direction.

German Aeronautics

The Director of the "Aero Union," a German Aircraft Corporation, with headquarters in Berlin, which controls and operates the "Deutsche Lufttreederei," a German Air Traffic Company, announced recently that his company has made arrangements to establish an aircraft factory near Pisa, Italy, and that the production of all-metal Duraluminum aeroplanes is expected in May or June, 1922. The raw material for these aeroplanes will be shipped from Germany and worked up and assembled in Italy by German and Italian workmen. The "Aero Union" was organized a few months ago, and is controlled by a combination of the "Allgemeine Elektrizitäts Gesellschaft" (the General Electric Company of Germany), the Hamburg-American shipping interests, and the Zeppelin Aircraft interests.

Announcement has also been made that the "Aero Union," in cooperation with the Russian Government, has organized a company under the name of "German Russian Air Transportation Company." The company hopes in the Spring of this year to organize a regular air service between Germany and Russia with passenger airplanes of the Russian Government, temporarily on the stretch between Königsberg-Moscow, in close connection with the Berlin Evening Express and return. The preparations for this are being directed by German and Russian technical experts. The service will primarily be for the purpose of transmitting official courier mail matter from Berlin to Moscow and Moscow to Berlin, as well as passenger and light freight service.

Progress in England

The promotion of a great flying festival at the London Air Station, Croydon, is a matter that is engaging the attention of the Air Ministry, Aircraft Constructors, Aero Club, Aeronautical Society and Air League. The festival is to last a week, will probably take place early in 1923, and is being designed to fasten attention on flying in a way that has hitherto not been found possible. The main feature of the festival will be an exhibition of every type of modern flying machine, including, it is hoped, helicopters. Concurrently, an international congress on air problems will be held, and speed and duration tests organized and decided. An effort is also being made to arrange that the Royal Air Force annual pageant shall be held at Croydon during the week.

In order to speed up the delivery of goods to Paris from Manchester or other provincial towns in England, a night aeroplane service will shortly be inaugurated whereby parcels dispatched by passenger train after business hours from these towns will be collected by a special motor van from the London Railway Terminal between midnight and 1:00 a.m., and immediately thereafter put on board the night express leaving the London airdrome at 2:30 a.m., and scheduled to arrive at Paris at about 5:00 a.m. Upon arrival in Paris the goods will, by special arrangement, be passed through the French customs and delivered by motor van in Paris as soon as business houses are open. A similar arrangement is to be instituted in connection with goods from provincial towns in France consigned to London, an air express leaving Paris early in the morning and parcels sent from, say, Lyons or Lille, after business hours one evening will be delivered in London the following morning, or in Manchester or other towns by the afternoon.

The night expresses which are now being built will be equipped with instruments and navigation lights for night flying, and this, in conjunction with the illumination of the London to Paris Airway, soon to be completed, will make night flying a safe and regular operation.

With the opening on April 3rd of the new Paris-London Aerial Company, known as the Daimler Airway, the number of British companies operating regularly between London and Paris has been raised to three, the other two being the Instone Air Line and the Handley Page Co. The new company will use the latest type of D. H. machine, known as D. H. 44, and will run a daily service in each direction. There are also two French companies working on the route. Even at this time of the year a regular flow of passengers continues, most of them being American and English family parties on holiday.

Rotterdam-Copenhagen Service

According to FLIGHT (London) arrangements have been made for inaugurating an air mail service between Rotterdam and Copenhagen. The company which is to undertake the new service is stated to be Danish, although it is intended to use British machines and pilots. The plan is to have machines leaving Rotterdam in the morning, after the arrival of the night boat from London, and it is expected that they will be able to reach Copenhagen shortly after noon, so that the mails should be distributed early in the afternoon in that city. In the opposite direction machines will leave Copenhagen at 3:00 p.m., and will reach Rotterdam in time to connect with the night boat to London. Thus, instead of taking 72 hours, the mails between London and Copenhagen should do the journey in about 24 hours.

Netherlands Activities

The Royal Aerial Navigation Co. of the Netherlands carried during 1921 a total of 1,548 metric tons of mail, 36,634 metric tons of freight and 1,674 passengers. The Amsterdam-London line accounted for more than half of the mail and merchandise, carrying 844 tons of the former

and 24,875 tons of the latter. In 1921, 931 passengers traveled on the Amsterdam-Brussels-Paris line and 254 on the Rotterdam-Hamburg line. These figures indicate a marked increase over the 1920 volume of traffic, which totalled only 3 tons of mail, 22 tons of freight and 345 passengers.

French-Italian Race

The greatest of many attractions at the aviation meeting held at Nice this Spring was a speed contest between two of the fastest aeroplanes in the world. Sadi-Lecointe, the French champion, met Brack-Papa, the famous Italian flyer, the Frenchman being on a small, speed Nieuport scout plane, while the Italian had a high-speed Fiat bombardment aeroplane driven by a Fiat 12-cylinder, 700 h.p. engine.

The two champions were very closely matched. At the outset of the aerial race Brack-Papa got a slight lead and maintained it to the end, for he covered the course on his Fiat in 9 min. 42 3/5 seconds, compared with 9 min. 50 seconds for Sadi-Lecointe's Nieuport. The speed of the planes was about 190 miles an hour.

Durban Aerodrome

The work of filling in and leveling the ground on the Eastern Vlei near Durban, set aside for an aerodrome, has now been completed, but nothing else has been done, and it will be left to private enterprise to convert the area into a suitable flying ground, reports the *Natal Mercury*. All the municipality was concerned with was the setting aside and levelling of the area. At present there does not seem much chance of a rush of applicants for accommodation, as there has been no flying in Natal for some time, but the Town Council were right in preparing an aerodrome, as commercial flying has come to stay, and in the near future South Africa will have to fall into line with other countries in adopting and encouraging aviation.

Germany Will Extend Commercial Air Lines

German commercial aviation circles are making extensive plans to resume and extend international air service when the Allies, as announced, remove their military control May 5. Prior to this the Germans could not establish international lines. Some companies evade the interallied control by establishing companies in other countries, notably Holland.

A scheme has been perfected for a Berlin, Danzig, Kovno, Moscow to Peking this year. Inside of Germany there has been an increase recently in the number of air lines. The Hamburg-Amsterdam line have been closed down, but toward the east there is the line to Stuttgart which was established recently. Airplane service between Munich and Constance has been resumed. There is a new line between Bremen and Dresden and during the summer aeroplane traffic between Berlin and Hamburg and north and Baltic resorts will be resumed. The Government is not now supporting commercial aviation, but German business industry stands behind German aviation.

Aircraft in Chinese War

The forces of Sun Yat Sen, head of the South Chinese Government at Canton, have captured the entire Southern Naval Squadron, it was stated in unofficial despatches published by the foreign and Chinese press.

The squadron captured, although containing some of the most important Chinese war vessels, amounts to little from a naval standpoint authorities agree. The ships captured, reports stated, include the cruiser Hai Chi, the largest vessel in the Chinese Navy, but of only 4300 ton displacement; the cruiser Hai Chen, the gunboats Chu Yu, Yung Pen, Yu Chang, Yung Shan, Fei Ying and Yun Yan, the training ship Che Ho and the transport Fu An.

The attack on the vessels which resulted in their surrender was carried out by aircraft in conjunction with South Chinese troops. The aircraft bombed the vessels in the Pearl River, twenty men being killed and thirty others wounded on board the cruiser Hai Chi in the initial attack, the reports state.

Later there was a further bombing attack on the vessels near Canton in the Whampoa River, the Hai Chi and other craft surrendering.

(Concluded from page 219)

performance are taken to a laboratory, greatly enlarged for study, and then plotted on a single sheet so that a complete story of the particular flight or manoeuvre is ready for analysis.

The instruments developed have been employed at the free flight laboratory of the National Advisory Committee for Aeronautics at Hampton, Va., by Test Pilot Thomas Carroll, studying ordinary and "stunting" manoeuvring, including looping, rolling, the so-called Immelman turn and reverse turn. An extensive study of landing and taking off has also been made.

In his report on the tests, Pilot Carroll emphasized the importance of "taking off" and "landing," which are the dominating factors of the efficiency, and perhaps the longevity, of a pilot. Of the two, he says, landing is perhaps the more important, for it is in this phase that the majority of accidents and damages occur. A paper on "taking off" and "landing," by Major R. M. Hill, a British flying officer, is the only one known to have been published on these important manoeuvres and it was this treatise that inspired the tests and developments undertaken by the National Advisory Committee for Aeronautics in this country.

ELEMENTARY AERONAUTICS and MODEL NOTES

Scale Model Built by Aerial Age Reader

Douglas Young, of Westboro, Ontario, a veteran model builder and a member of the Flight Association of Ottawa, Canada, has completed a neat model of the Newport Chasse plane. This model is complete with all controls, bucket seat, harness, dummy rotary engine with cooling flanges, exhaust pipes, push rods, etc. The propeller, machine gun, etc., are all to scale and all details such as the instrument board, landing chassis, etc., are carefully formed to correct proportions.

The finish is of aluminum color, with the red, white and blue insignias and rudder markings of the French Army Air Service.

The scale is one-tenth full size, the wing span being reduced in this proportion to approximately 32 inches.

Hydro Models Giving Good Performance

SGT. Joseph S. Ott, of College Station, Texas, whose extensive work on model aeroplanes has been mentioned in these columns before, gives an instructive description of one of his successful models, a 21-inch hydro which will fly 400 to 500 feet, rising from the surface of the water. This tractor model leaves the water after skimming the surface for only about 5 to 6 feet, is very dependable in its performance and never fails to take off properly.

The specifications of the Ott 2½-inch hydro model are as follows:

Wing span	21 inches
Wing chord	3½ inches
Weight .....	.97 ounce
Propeller diameter	7 inches
Propeller pitch	5 inches
Power—(elastic, 3-16 inch flat)	3 strands

The motor stick is 3-16 inch by 3-32 inch, with a ring attached at the middle to support the rubber power in position. By this arrangement the propeller may be turned 800 revolutions without danger of twisting the frame too greatly.

A block of white pine ¼ inch by ½ inch is used for the propeller blank.

Floater are 1½ inches wide, ¾ inch deep and 4 inches long. The frame is built up of strips measuring 1-32 inch by a thickness less than 1-16 inch in section.

The wing has a pronounced dihedral which decreases the actual span to 21 inches, although the wing measures 24 inches flat plan. There are seven bamboo ribs attached at each end to white pine spars 3-32 inch by slightly less than 3-16 inch.

Horizontal stabilizer measures 3½ inches in length and 4½ inches in width. Thread is used for the edges, completely

around. A triangular fin aft of the stabilizer measures 2 inches in height and 3 inches in length.

Another of the Ott hydro models giving good performances is the little twin-pusher having a 26-inch wing span. Its weight is very low; a trifle less than 1¾ ounces. The specifications are as follows:

Wing span	26 inches
Wing chord	4 inches
Weight	1.74 ounces
Propeller diameter	7 inches
Propeller pitch	7 inches
Power—(elastic, 3-16 inch flat)	3 strands

The A frame is 26 inches long, ¼ inch by 1-16 inch in the center and tapering to 3-16 inch by 1-16 inch at the ends. Cross braces are 3-32 inch by 3-64 inch, using two X pieces and 3 straight members.

Hook and shafts for the propellers are of number 14 piano wire. There are two propellers, turning in opposite directions, to counteract against torque or twisting. The propeller blanks are cut from blanks of white pine ½ inch thick and ¾ inch wide.

Main wing frame is of pine. Diamond or pointed tips of bamboo. Seven ribs, 1-32 inch by 1-16 inch are used. Covering on the top surface only.

The elevator is 12 inches in span, 2½ inches wide. Bamboo construction throughout. No elevating blocks are used, but the elevator wing tips are bent upward about ½ inch to give the required lifting angle.

Chassis members are a trifle under 1-16 inch square.

There are two floats at the front and one at the rear of the frame. Front floats are 4 inches long, 1¾ inches wide and ¾ inch deep, coming to a point at front and rear. They are patterned after the shape of a snow shoe. Rear float 5 inches long, 2 inches wide and ¾ inch deep.

Two coats of Shellac are applied to the framework and wings to render them as completely waterproof as possible.

The elastic motor takes 950 turns and it is powerful enough to take the model off in a moment. By decreasing the angle of the front floats, the model will run over the surface for about 6 or 7 feet before taking off. Landings are made in perfect balance.

Best results are obtained when the main wing is located about ½ inch behind the center of gravity. This permits the model to assume a very flat glide when the power has been used up. Better gliding is also accomplished by a gradual decrease in the incidence or lifting angle of the elevator plane, although if sufficient lift is not obtained, the model will not leave the water quickly and the duration of the flight will be decreased.

Flights of 800 feet are made with the 26-inch model, starting from the water under its own power.

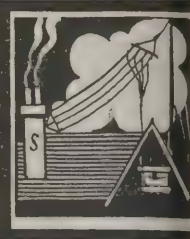
Mr. Ott has designed quite a variety of models, from small tractors to compressed air types, and the details of some of the more popular types will be published in forthcoming issues of AERIAL AGE.

Hydro models designed by Sgt. J. S. Ott, U. S. Air Service. At the right is a 26" twin pusher. At the left a 21" tractor which will fly 500 feet





RADIO DIGEST



New York Mayor Requests Radio Appropriation

The special Radio Committee appointed by Mayor Hylan of New York City about a month ago decided to recommend the erection of a city broadcasting station on top of the Municipal Building.

The station is to cost \$50,000, and its erection is to be under the supervision of the Department of Plant and Structures. The Board of Estimate will be asked by the committee to appropriate the sum at its meeting Friday.

The meeting was held in the office of Rodman Wanamaker, Special Deputy Police Commissioner, one of the members of the committee, with these other members in attendance: Borough President of Queens Connolly, Commissioner of Plant and Structures Whalen, Col. Barrett Smith of the Department of Water Supply, Arthur S. Tuttle, chief engineer of the Board of Estimate, and City Chamberlain Berolzheimer.

The appropriation covers not alone the broadcasting station, but many portable receiving stations that may be set up quickly in parks and other places where crowds gather—these receiving stations to have sufficient amplifying apparatus to carry to every ear in a multitude.

When the station is going, and the Mayor or one of the department heads wants to say something without using the medium of the public prints—presto! He calls for his radio crew, orders the receiving sets put up in all the boroughs, talks into the mouthpiece of his office telephone and the people will hear his own words in his own voice.

All the important orders and directions of the Fire, Health and Police Departments are to be broadcast from the Municipal Station. Whenever a distinguished visitor from abroad calls to pay his respects to the Mayor, the freedom of the broadcasting chamber is to be conferred upon him, so that the feted stranger may address not only a populace of newsboys in front of City Hall steps, but many thousands of citizens elsewhere.

Lest the appropriation be regarded as an extravagance, in view of the many broadcasting stations now keeping citizens listening close to home, this economy feature was mentioned, with suitable cheers, at the committee's meeting:

Music is to be supplied to parks through the municipal broadcasting station.

One band will do for all parks!

One really good band may be hired instead of several lesser bands.

The amplifying apparatus will do the trick.

Radio Tests at Camp Vail

Captain Clyde V. Finter, A. S., left for Camp Vail, April 10, 1922, under orders from the Chief of Air Service for the purpose of co-operating with that station in the development and testing of radio apparatus. This work will occupy about ten days. The plane which Captain Finter flew from Mitchel Field was equipped with the most modern type of radio sending apparatus. Mitchel Field was continuously in touch with Camp Vail by radio telephone during the period of these tests.

New Radio Station at Aberdeen, Md.

A new radio station has been opened at the Airship Field, Aberdeen Proving Grounds, with an S. C. R. 109 set as the main operating equipment. A wave length of 850 meters has been assigned this set by the Signal Officer of the 3rd Corps Area.

National Guard Unit Will Give Weekly Radio Concerts

The following statement has been issued by the Signal Corps of the National Guard of New York.

"The commanding officer of the 101st Signal Battalion, N. Y. N. G., realizing the tremendous interest aroused by the broadcasting of radio music and news, has authorized the institution of a series of radio concerts, to be held at the Signal Corps Armory, Park Avenue and Thirty-fourth Street, on Wednesday evening of every week.

"Such complete equipment as is necessary will be utilized to reproduce the best possible radio music. Tickets for these concerts may be secured by applying to Lieutenant W. B. Schreiber, of Company A, 101st Signal Battalion, Park Avenue and Thirty-fourth Street.

"Little is really known of the great work done by the battalion. Members of the organization, drawn from every walk of life, have been busy for months undergoing a course of instruction that includes, in addition to the popular radio telephony, radio telegraphy, Morse telegraphy and ordinary telephony. The organization is a federalized unit, the members drawing Federal pay for attendance at drill. The powerful station at the armory operates from Fort Wood, on Bedloes Island, headquarters of the 2d Corps Area, which includes most of Greater New York.

"The training and education afforded the members of the unit provide new fields of endeavor for all. In addition to the technical work necessary and required of each man, the usual routine of military training is also included in the course of instruction. Marksmanship, elementary and advanced electricity, first aid, personal and camp hygiene and the ordinary infantry tactics compose the general program.

"The series of radio concerts is the best evidence of the thoroughness of the training afforded and provided by the organization. The operation of the receiving sets will be conducted by enlisted men of the battalion, many of whom knew little or nothing regarding the manipulation of the various pieces of apparatus at the time of joining the organization.

"Of course, there are numerous other features and advantages, as entertainments, athletics and any variation of club privileges make possible the enjoyment of membership in the organization that compares very favorably with the average social or athletic association.

"The history of the organization is a most interesting one and dates back to the late '70s, when the first signal company was organized in New York. The members have, as a unit and individually, taken part in the Spanish-American War and the recent great World War, establishing reputations that are looked upon with pride by the present organization. The enthusiasm shown around the armory by the members

marks well the intense interest the men take in their work and the pride manifested in their being signalmen.

"Application for membership can be made to Lieutenant H. G. Martin, Jr., recruiting officer, 101st Signal Battalion, N. Y. N. G., Park Avenue and Thirty-fourth Street."

Presides By Radio

For the first time in history, two meetings of electrical men were called to order April 26 by radio telephone. Walter Newmuller, Secretary of the New York Edison Company, at the broadcasting station of the Western Electric Company, West Street, New York, talked before members of the New York Electrical League at the Hotel Astor and the New York Electrical Society at the new Hell Gate Station of the United Electric Light and Power Company.

He called the meetings to order at noon and after a short opening address introduced several opera stars, who rendered selections over the radio. Mr. Newmuller then went to the Astor to preside over the meeting of the New York Electrical League, and Thomas E. Murray, Vice President of the New York Edison Company, also rendered several selections over the radiophone. John Miles of the Western Electric Company discussed radio problems at the Astor.

International Conference To Standardize Radio

Paris.—The International radio conference of Americans, British, French and Germans, which is attempting world-wide standardization of wireless traffic, will resume its sessions at London on April 2 when it is hoped final agreements will be reached. The United States is represented by the Radio Corporation of America, England by the British Marconi Company, Germany by the Telefunken Company and France by Radio-France.

Five day sessions in Paris is understood to have been devoted principally to discussion of the use of different wave lengths by various countries to avoid interference and international agreements governing sending and receiving. These experts will meet in Berlin in June to present complete findings.

Although he declined to disclose the results of the conference, Edward J. Nally, president of the Radio Corporation of America, who, with Owen D. Young, vice president of the General Electric Company represents American interests, said the delegates were endeavoring to devise means for the extension and proper control of broadcasting. He added that Germany, France and England were sending experts to the United States to study distribution methods there.

"One of our greatest hopes for the future," said Mr. Nally, "is the establishment of an international radio language code, like Esperanto, which could be understood by all. This would place the activities of the whole world at everybody's ear. There is no reason why every American schoolhouse should not have a simple wireless apparatus to enable teachers to have pupils to listen to what the rest of the world is doing."

Conference to Draw Schedule

The sudden increase in the number of radio broadcasting stations in and around New York city all operating upon a 360-meter wave, has produced a serious situation, which may develop into troublesome interference. This fact is realized by the operators of the stations in question, and there is a possibility that a conference will be held during the coming week to solve the problem caused by the stations.

In all probability some schedule will be evolved at the conference whereby all of the stations can operate during the day without interfering with each other. At the same time it is expected that the large commercial broadcasting stations which have been in operation for some time will be given a preference in operation.

New Radio Code Issued by Fire Underwriters

The National Board of Fire Underwriters have made public tentative regulations covering radio receiving installations that include considerable modification as compared with the requirements previously issued by fire underwriters.

The specifications that follow were drawn up by a special committee of the National Fire Protection Association, which is the authority for the national electrical code and whose findings are standards of engineering practice. Besides the underwriting organizations represented upon this special committee, engineers acting for the American Radio Relay League, American Telephone and Telegraph Company, Radio Corporation of America and the Independent Telephone Association also participated.

The new rules are being published as proposed amendments to be included in future editions of the electrical code. It is stated that the requirements contained in the current edition of the code were based largely on the hazards incident to the equipment of wireless telegraph transmitting stations where antennae of considerable height and length were used and where the hazard of high potential equipment had to be considered.

The recent widespread installation of radio telephone receiving sets has necessitated a revision of the regulations. The receiving set having an indoor antenna is considered devoid of hazard. With any receiving set, the publication says the principal danger is from lightning brought in by the antenna to the equipment or to some part of the building. Where there is an exterior antenna this hazard is removed. The following specifications are for receiving stations only:

NATIONAL ELECTRICAL CODE

Specifications (for Receiving Stations only):

Antenna

"a. Antennae outside of buildings shall not cross over or under electric light or power wires of any circuit carrying current of more than six hundred volts, or trolley or feeder wires, or shall it be so located that a failure of either antenna or of the above mentioned electric light or power wires can result in a contact between the antenna and such electric light or power wires.

"Antennae shall be constructed and installed in a strong and durable manner and shall be so located as to prevent accidental contact with light and power wires by swinging or swinging.

"Splices and joints in the antenna span, unless made with approved clamps or splicing devices, shall be soldered.

"Antennae installed inside of the build-

ings are not covered by the above specifications.

Lead-In Wires

"b. Lead-in wires shall be of copper, approved copper-clad steel or other approved metal which will not corrode excessively, and in no case shall they be smaller than No. 14 B. & S. gage except that approved copper-clad steel, not less than No. 17 B. & S. gage may be used.

"Lead-in wires on the outside of buildings shall not come nearer than four (4) inches to electric light and power wires unless separated therefrom by a continuous and firmly fixed non-conductor that will maintain permanent separation. The non-conductor shall be in addition to any insulation on the wire.

"Lead-in wires shall enter building through a non-combustible, non-absorptive insulating bushing.

Protective Device

"c. Each lead-in wire shall be provided with an approved protective device, properly connected and located (inside or outside the building) as near as practicable to the point where the wire enters the building. The protector shall not be placed in the immediate vicinity of easily ignitable stuff or where exposed to inflammable gases or dust or flyings of combustible materials.

"The protective device shall be an approved lightning arrester, which will operate at a potential of 500 volts or less.

"The use of an antenna grounding switch is desirable, but does not obviate the necessity for the approved protective device, required in this section. The antenna grounding switch, if installed, shall in its closed position form a shunt around the protective device.

Protective Ground Wire

"d. The ground wire may be bare or insulated and shall be of copper or approved copper-clad steel. If of copper the ground wire shall be not smaller than No. 14 B. & S. gage, and if approved copper-clad steel it shall be not smaller than No. 17 B. & S. gage. The ground wire shall be run in as straight a line as possible to a good permanent ground. Preference shall be given to water piping. Gas piping shall not be used for grounding protective devices. Other permissible grounds are grounded steel frames of buildings or other grounded metallic work in the building and artificial grounds such as driven pipes, plates, cones, etc.

"The ground wire shall be protected against mechanical injury. An approved ground clamp shall be used wherever the ground wire is connected to pipes or piping.

Wires Inside Buildings

"e. Wires inside buildings shall be securely fastened in a workmanlike manner and shall not come nearer than two inches to any electric light or power wire unless separated therefrom by some continuous and firmly fixed non-conductor, making a permanent separation. This non-conductor shall be in addition to any regular insulation on the wire. Porcelain tubing or approved flexible tubing may be used for encasing wires to comply with this rule.

Receiving Equipment Ground Wire

"f. The ground conductor may be run inside or outside of building. When receiving equipment ground wire is run in full compliance with rules for protective ground wire, in 'Section D,' it may be used as the ground conductor for the protective device.

"Regulations covering sending stations have also been drawn up and copies may be secured from the National Board of Fire Underwriters."

Recruiting By Radio Brings Results

It will be remembered that the News Letter of February 18th published the fact that Mitchel Field had adopted a novel plan of recruiting by radio telephone and had sent broadcast a message calling for enlistments for the various Air Service organizations at that station. As evidence of the fact that this method is effective, letters have reached Mitchel Field from far and wide in reply to this request for recruits. The latest response came from Buffalo, N. Y., in which an applicant for enlistment stated he had received information by radio telephone that Mitchel Field desired recruits for the Air Service. By this and other means, and the very active recruiting efforts on the part of the recruiting office at Mitchel Field, 28 recruits were secured for the Air Service organizations at that station during the month of March.

Books on Wireless

RADIO FOR EVERYBODY. By Austin C. Lescarbourea. Scientific American Publishing Company.

This volume has been written specially to meet the situation that has arisen as a result of the broadcasting system of radio-telephone concerts. It is written in language that the layman can understand, and covers practically every phase of the radiophone, from the apparatus at the broadcasting station down to the various types of receivers that are being used by the general public.

In his introduction Mr. Lescarbourea says that in order to get into sympathy with the views of the novice he specially installed a receiver to listen into the concerts, so that he could study the subject from the viewpoint of music reception. "Indeed," he says, "the manuscript for this book was written on the very table where I have my radio receiving set."

The book is profusely illustrated with photographs showing various types of receiving and transmitting equipment used in wireless telephone work. There are also a large number of diagrams showing connections for different circuits.

One chapter is devoted to the tuning and adjustment of receiving sets, and another to "Making big sounds out of little ones, or the gentle art of amplifying."

ACQUIRING THE CODE. By E. P. Gordon. Wireless Press, Inc.

Now that broadcasting has become popular many novices listening in have been actuated by a desire to learn the continental telegraph code so that they can decipher the messages which they hear surging through the ether. This little volume goes into the subject thoroughly and shows the beginner just what to do in order to avoid many of the errors usually committed in learning the code.

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AERIAL AGE

WEEKLY

VOL. 15, No. 11

MAY 22, 1922

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Aerial Mail Night Flying—Showing an Aviator How he Flies—Advantages of Aerial Mail

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NEW YORK, MAY 22, 1922

No. 11

Aero Club Doing Good Work

THE following official bulletin from the Aero Club of America outlines far-reaching educational work which that organization is now engaged in. There is a certain group of individuals in the United States who are not going to let other countries get ahead of this nation in the "Air". They say at the world powers are today so financially embarrassed that they cannot support huge standing armies and navies and that the next emergency will be marked with a great offensive in the "Air", each side aiming to strike so sudden, so strong and so quickly, that the other will be unable to mobilize its civilian army and navy reserves.

But not only for national defense do they foresee the power of the aeroplane but realizing the all-importance of speedy transportation in any community or state, they foresee the building up of new industries relying on the speed of the aeroplane and demanding this new medium of intercommunication.

Although the aeroplane is a native son of the United States, it appears to be stunted in its growth in its own home locality. There is no directing thought in the country. Here and there one finds sporadic effort on the part of local clubs and societies to develop this power but they are all working at cross purposes. The time is now ripe for an association that all will join and by the united front all "Pull Together" for the furtherance of "Air Power" in the United States. The sponsors of this movement say that this body must be entirely independent and they are giving a great deal of thought and hard work to making a democratic, non-partisan, representative association that will not reflect the wishes of any particular community but speak in the behalf of the nation as a whole, so that the necessary legislation, the necessary airways, routes and landing fields, within as short a time as possible be brought into existence. They state that with these well established air routes, with the overhead taken care of as it should be, air lines will be a certain success and flying will become every-day and commonplace, safe and regular.

From a standpoint of national pride alone, prompted by no other motive than to keep America first in the "Air" at all times, they are working to bring this about and in this connection Mr. Admiral W. F. Fullam, U. S. Navy, retired, is making a tour of the United States giving lectures, showing the wonderful strides aeronautics has made and organizing the districts and states on behalf of the new association. His route is outlined as follows: Atlanta May 7th, Birmingham May 10th, New Orleans May 12th, Houston May 14th, San Antonio May 17th, Los Angeles May 20th, San Francisco May 24th, Portland, Ore., June 2nd, Seattle June 3rd, Spokane June 5th, Minneapolis June 9th and Chicago June 11th.

Admiral Fullam is attempting to have every city organize an Air Board, this Board to consist of representatives from each society or organization interested in aviation. Chicago already had an Air Board for some time now and it has proved an excellent organization for getting results.

Admiral Fullam attended the Sious City, Iowa, Convention last March and is in an excellent position to direct the other districts in their organization work.

Aerial Mail Night Flying

NIGHT flying, soon to begin on the air mail line across the continent, will render a double service to this country, in the opinion of aeronautical authorities.

Not only will it make it possible for a letter to be shot across the country from San Francisco to New York in twenty-four hours or so but the experience gained in operation will do much to speed the establishment of regular lines of aircraft which will fly day and night.

The competition between aeroplane and railroad train in carrying mail has been somewhat like the celebrated race between the hare and the tortoise, because the tortoise train travels all night while the hare plane stays still on the ground. Even without night flying air mail travels about twice as fast as train mail, but with night flying experts believe train mail will be made to appear like slow freight.

The announcement of night flying was made by Col. Paul Henderson, Second Assistant Postmaster General, in charge of air mail, with the reservation that it would not be attempted until the engineering staff of the service had completed its work of making this type of aviation safe.

When the first plane takes off from Curtiss Field, Garden City, for a night flight, it will not head westward with a depressed pilot, hand glued to stick and eye watching an unsteady compass, wondering where in this or the next world sunrise will find him.

Instead the plane will start with a confident aviator so equipped that it will be a difficult task for him to lose his way unless he loses both sight and hearing.

All the way across the continent this pilot and the pilots relieving him will be guided by beacons shining upward into the air from emergency landing fields thirty or forty miles apart. Thus, at no time during the flight will he be more than twenty miles from a field. In the event that he has to land because of motor trouble, a signal from the plane, a flare, will cause the illumination of the field by flood lights in addition to the beacon.

Each plane, instead of an oscillating compass which can not, because of drifting winds, be used with any certainty, will be equipped with a radio direction finder which will unerringly point the way to the next control field, despite fog, snow, rain or darkness.

These are the plans of the Post Office Department, and already they are well on the way to completion. The lights at the emergency fields, a great number of which already have been located, will be operated by the farmer owning the field.

(Concluded on page 263)



THE NEWS OF THE WEEK



National Balloon Race

The National Balloon Race will be held this year from Milwaukee, Wisconsin, May 31st, 1922, under the auspices of the Aero Club of Wisconsin. The following prizes are offered: 1st prize, \$1,000; 2nd prize, \$800; 3rd prize, \$600; 4th prize, \$300; 5th prize, \$200; 6th prize, \$100.

Entries have been received from the following: Ralph H. Upson, holder of Spherical Balloon Pilot Certificate No. 48; H. E. Honeywell, Pilot Certificate No. 20; J. S. McKibben, Pilot Certificate No. 135; Roy F. Donaldson, Pilot Certificate No. 47; Warren Rasor, Pilot Certificate No. 50; John Berry, Pilot Certificate No. 24; Bernard Von Hoffman, Pilot Certificate No. 888; also three Army and two Navy balloons.

Santa Maria, With 12 Aboard, Finishes Flight From Cuba

Completing the last leg of a trip that started at Havana, Cuba, the giant flying boat Santa Maria arrived at its station in the North River, New York City, at 2:30 P. M., May 9th.

Aboard the craft were the crew of three and nine passengers. The flight was begun on the previous Wednesday, and was broken by seven landings. A distance of about fifteen hundred miles was covered by the boat, with an elapsed flying time of seventeen hours and thirty-five minutes, as compared with the fifty-seven hours required to make the trip by rail and steamer and the three and a half to four days required by steamer alone.

The Santa Maria was met by a committee representing the Army and Navy Air services, the Aeronautical Chamber of Commerce, aircraft manufacturers and the Aero Club of America. Among those present were Major A. N. Krogstad, representing General Bullard; Commander E. Frederick, representing Captain Vogelgesang, commandant of the 3rd Naval District, and Colonel L. La Tourette Driggs, chief of the New York National Guard Air Service.

The hydroaeroplane returned to the factory at Keyport, N. J., and will come back to the New York City Air Port to be exhibited, when its owner, the Aeromarine Airways, Inc., will inaugurate its summer flying season.

Field at Sheldon, Ill.

The Sheldon Airline, of Sheldon, Ill., announce that they have acquired a landing field eighty rods by forty rods, clear on all sides, and marked with a "T." It is located on the main line between Indianapolis and Chicago, one mile south of Sheldon. Repairs and gasoline are available and fliers are welcome.

Commissioner Frazar in New York

Mr. E. W. Frazar, Commissioner, The World's Board of Aeronautical Commissioners Inc. for Japan and Corea, is in New York.

Speaking of Aeronautics in Japan, Mr. Frazar said Japan was far advanced and making wonderful progress on lines of aerial navigation. Mr. Frazar in co-operation with Mr. George Scott, Manager of the Rising Sun Oil Company of Japan (The Shell Oil Co.) has completed the delivery of oils and gasoline for the round-the-world flight from Shanghai via the

Aleutian Islands to Alaska and San Francisco.

The stations supplied are Shanghai, Fuson, Tokyo, Kushiho, Etorofu Islam, Petropavlovsk, Kamchatka (Japanese territory), Attu Islands (American territory), Chicago Bay, Alaska points to San Francisco. Landing places in good harbors are about 150 miles apart.

The Tokyo Flying Staff located at Kasunigaura under command of Colonel De Master Semple, with Major Brackley (favorite pilot for the King of Belgium) Chief Instructor, is composed of thirty-six British Naval expert flyers. The entire staff are much interested in the around-the-world flight and will, with the assistance of Major Christie, U. S. Naval Attache, render all possible assistance to the flyers that the Pacific Ocean flight may be a success.

The Japanese fishing fleet between Yokohama and the mouth of the Kamchatka River, 1,945 miles, is composed of ten thousand fishermen. They with the Japanese and American Navy in Asiatic Waters, The Canadian Pacific Steamship Company, will be on the watch for them and render any assistance that may be required.

Mr. Frazer will be at Petropavlovsk near the mouth of the Kamchatka River during July and August and says those two months are best for the flight as the locality is free from fogs and ice.

Aerial Carnival Over Hudson

What was described as a new passenger-carrying seaplane record was established May 14, when the Aeromarine flying cruiser Menrosa, with twenty-seven passengers aboard flew from Keyport, N. J., to the New York airport, at Eighty-second Street and the Hudson. The Mendosa, an enclosed plane, luxuriously furnished, was a feature of a flying-boat carnival that attracted a throng of thousands.

The Mendosa flew from Keyport to the city, an air distance of thirty miles, in twenty-one minutes. The huge craft, painted white and flying an American emblem from one of its stay wires, circled over Riverside Drive and then gracefully alighted on the surface of the river. The cruiser "taxied" into shore, where an opportunity of inspecting it was accorded visitors.

Laurence La Tourette Driggs, founder of the American Flying Club, said the plane, seen here for the first time, was the last word in modern construction and equipment.

"It will not be long before the public will adopt this mode of transportation as a necessity," he said. "Why travel by railroad to Atlantic City, for example, a journey of hours, when you can fly there just as comfortably in seventy-five minutes?"

The Mendosa has a spacious cabin with seats arranged along the side. It is electrically lighted and glass enclosed, a clear view thus being afforded of the country over which the traveler is passing. In the rear is a separate compartment seating three for those who desire seclusion. A feature is the arrangement of the pilot's seat whereby the passenger may watch the operation of the plane. The Mendosa has a wing spread of 104 feet and is motored with two 400 horsepower Liberty engines.

Contrasting in size with the Mendosa and the Santa Maria, a sister plane, was an Aeromarine sport boat, with a forty-eight foot wing spread, which was used in giving flights to those who preferred an open machine.

In addition to the flight program, series of manoeuvres intended to demonstrate the various points of seaplane operation was carried out. The carnival was announced as opening the flying boat season in this city.

During the afternoon more than a hundred invited guests flew down the bay. While waiting their turns, they were entertained aboard the steam yacht Waden. The Reception Committee consisted of: Inglis M. Uppercu, C. F. Redden, H. Bruno, Earl D. Osborn and F. Rodriguez.

Among those present, most of who took flights, were Commander Victor Herbster, representing the Naval Air Service; Major A. N. Krogstad of the Army Air Service; Lieut. Commander Mar Zar of the Argentine Naval Commission; Murray Hulbert, President of the Board of Aldermen; Felipe Taboada, Consul General of Cuba in this city; Mr. a Mrs. Laurence La Tourette Driggs, M. Diane Gordon, Francis H. Markoe, Do Commissioner John H. Delaney, and Mrs. T. L. Oakley Rhineland.

Police Air Reserve Is Now Part of Navy

The Aviation Division of the Police reserves of New York City, including in its membership some of the best flyers in the war, has been mustered into the Navy reserves. The actual transfer of the "flying cops" into Government service took place this week, and plans were said to be under way to furnish the naval reservists with complete aerial equipment.

Organized three years ago with Roman Wanamaker, who financed the Wellman expedition, as one of the sponsors, the aerial division has been handicapped by lack of funds. Mr. Wanamaker was understood to have contributed heavily to the outlay as the aviation school has been maintained at the headquarters of the division in the Greenwich Street station, where two students have been graduated as licensed pilots.

For a time the "flying cops" had the use of four hydroplanes lent by the navy. Four members owned aeroplanes which they placed at the disposal of the division. This completed the aircraft equipment of the force.

It was pointed out that the city benefited despite the merging of the division with the navy as the aviators retained their memberships in the Police Reserves, Class VI., into which the flights have been allocated, renders them available in case of emergency.

Cleveland Aviation and Athletic Club

The inaugural banquet of the Cleveland Aviation and Athletic Club was held at the Hotel Winton on May 13. Addresses were delivered by Capt. Eddie Rickbacker, Paul Henderson, Second Assistant Postmaster-General, Rear Admiral A. Moffat, Chief of the Bureau of Aeronautics, Lt.-Col. H. E. Hartney and William L. David. The banquet officially opened the club's new quarters.

The AIRCRAFT TRADE REVIEW

Aeromarine Performance

One of the most important developments in American civilian aviation is the successful operation of the Aeromarine Airways, Inc., of New York, Key West and Havana. Convinced that commercial aviation could be made a safe and financially successful business enterprise if conducted by an efficient organization possessing proper equipment, officials of Aeromarine Airways started their Key West Havana service in the winter of 1920-21. At the close of their second southern season on April 1st, last, Charles F. Redden, president, set to work checking up figures, operating costs and statistics. The books of the company showed that it had made money; but he wanted to know how closely the practical results coincided with the theories on which they have based their operations.

He found that Aeromarine Airways from November 12, 1920, to April 1st, 1922, had flown an aggregate distance of more than 150,000 miles and carried a total of 10,700 passengers—without an accident. Since last November (1921) Aeromarine Airways made:

184 flights between Key West and Havana; 55 flights between Key West and Miami, Fla.; 91 flights between Miami and Key West; 53 flights between Miami and Nassau; 16 flights between Miami and Palm Beach; 345 special charter and miscellaneous sightseeing flights.

In last period, the season just closed, 8,535 passenger miles were flown, in a total of 713 hours in the air. Out of the total of 749 flights, all but five were completed; the five being discontinued because of weather conditions, and the planes returned to the starting point. Not a single passenger or employee was injured in these operations. The schedule was maintained throughout, with the exception of the five postponed flights. Three types of flying boats were used: the 11-passenger flying cruisers of the F.5-L type, the Navy Coast Patrol 6-place Hs2L type, and Aeromarine 3-place flying boats.

"Efficiency of the operating personnel, pilots and mechanics and officials at each stop, continuous inspection and maintenance of aircraft, adherence to the rule of 'Safety First' observance of weather conditions and knowledge of routes combined to bring about this progressive situation," says Mr. Redden in his report. "We know, now, that aircraft can be operated at a profit, without endangering lives."

International Air Lines in Europe

A meeting of the International Traffic Association recently held at The Hague was attended by the following persons: M. Hermant, representing the Compagnie France-Roumane; Mr. Jacobson, representing the Svenska Luft Trafik AB; Mr. Meisterlin, correspondent; member of the Association for Norway and representative of Det Danske Luftfartsselskab; M. Pierrot, representing the Compagnie des Messageries Aeriennes; Lieut. Plesman, of the K. L. M.; Mr. Renaud, representing the Societe Nationale

pour l'Etude des Transports Aeriens, and Herr Wronsky, representative of the Dantziger Luft Reederei and the Deutsche Luft Reederei.

Lieut. Plesman, manager of the Royal Dutch Air Navigation Company, was elected Chairman.

Discussion of plans for next summer resulted in the following international lines being decided on:

1. London-Amsterdam-Bremen-Hamburg-Copenhagen.
2. London-Amsterdam-Bremen-Hamburg-Berlin.
3. London-Brussels-Dortmund-Berlin.
4. London-Paris-Lyons-Geneva.
5. London-Paris-Lyons-Marseilles.
6. Amsterdam-Brussels-Geneva.
7. Paris-Strasbourg-Prague-Warsaw-Vienna-Budapest-Bucharest-Constantinople.
8. Konigsberg-Moscow, communicating with the railway services between Berlin and Konigsberg.

It was further decided that the Central Office should issue regulations for aerial services binding upon all the companies which were members. The Central Office was invited to communicate with the Secretariat of the International Postal Union, in order to call that Union's attention to the fact that, although it was impossible to maintain regular services throughout the whole year, such services were possible from April to September, so that during that time the mail can be regularly carried by aeroplane. The Central Office was also invited to communicate with the Traffic Committee of the League of Nations. Efforts will be made in the direction of simplification of customhouse formalities.

It was further decided that motors should be equipped with an apparatus which served to muffle the sound; that large passenger aeroplanes should carry a pilot and assistant pilot; that machines destined for flights lasting over four hours should be equipped with a lavatory, and that the main parts of the machines should be constructed in such a manner as to be easily exchangeable.

The French Companies, the Belgian and the Slovak Companies have been invited to become members of the Central Office.

The next meeting will be held on July 31st, probably at Brussels.

Petrel Performance

An interesting test which demonstrates the advance in aeronautical engineering made since the armistice, was held in Kansas City, on the American Legion Flying Field, when a Petrel three seater was demonstrated in competition with a one hundred fifty horsepower rebuilt Standard J1.

The Standard is a plane belonging to Mr. John K. Legrone, a veteran pilot of nine years' flying experience. The Petrel used was the demonstrator of the Huff, Daland Aero Corporation which has a main sales base at Kansas City.

The two planes, equally loaded, were taken off the same line at the same time. The Petrel got off the ground in approximately 140 feet or about half the distance required for the Standard. Both planes climbed at their best angles. After the Petrel had reached an altitude of 800 feet it was about 100 feet higher than the other plane and about 400 feet in advance of it. Both planes then levelled off for a speed test, in which it was evident to all spectators on the ground that the Petrel was from twelve to fifteen miles per hour faster in horizontal flight than the Standard, powered with a 150 HP. Hispano.

This test was taken by four or five hundred spectators to be a definite proof of the fact that aeroplane design in 1922 is a very advanced matter over the elements of design in pre-armistice days. It shows that engineers have profited by the vast amount of wind tunnel experimentation made since the war; that American engineers can design planes around foreign aerofoil curves; and that a distinct advance must have been made when a plane of less than thirty feet of wing span can outclimb and outperform a plane of materially greater surface, lighter load per square foot, and much less power.

Asparagus by Air, Jersey to Boston

Fresh asparagus for the midday dinner in the Back Bay district of Boston will be cut the same morning in the Gloucester County, New Jersey, asparagus centre and shipped by aeroplane. Gloucester County is completing details of an air freight daily delivery of 1,000 pounds of the "grass" as they call it in Swedesboro, N. J., so there will be plenty to go around at other Boston dinner tables.

Radio messages to the station of the asparagus kingdom will expedite filling orders. Bert Acosta will have a radio in his Fokker and persons who have transmitters and find they are licking their chops at 1,000 pounds of fresh tender asparagus flies over their heads can call him by radiophone.

Asparagus must be caught young and the Gloucester County Board of Agriculture knows it. Its leading members met recently in Mickleton, at the home of S. Mason Carter, Chairman of the Board's Transportation Committee. Alexis L. Clark, chief of the State Bureau of Markets, attended. It was agreed to send Acosta in his Fokker on a test trip to Boston last week with his 1,000 pounds of "grass" and President White of the Gloucester County board as passenger.

Junior Aeronautical Engineer

The United States Civil Service Commission announces an open competitive examination for junior aeronautical engineer on June 21, 1922. A vacancy under the National Advisory Committee for Aeronautics, at \$1,500 a year, will be filled from this examination. Applicants should apply for form 1312, stating the title of examination desired, to the Civil Service Commission, Washington, D. C.

AERIAL LAWS AND SURVEY OF SAFETY IN FLIGHT URGED BY AERONAUTICAL CHAMBER OF COMMERCE

THE following report covering the calendar year 1921 has been prepared by the Aeronautical Chamber of Commerce for the Department of Commerce.

Three deficiencies operate to the serious embarrassment of American aviation—meager capital, insufficient terminal facilities and popular doubt as to reliability. The correction of these deficiencies, and the consequent opportunity for the rapid growth of aerial transport, depend upon Federal regulation and reasonable control through an Aerial Code.

In a recent issue of Commerce Monthly, organ of the National Bank of Commerce of New York, it was declared: "Wise regulation may be expected to give a certain stability to the air transportation industry essential to any industry which must appeal for credit and for investment capital. Until this is attained air transportation can not be said to be on a business basis. From whatever point of view the subject is approached, the conclusion is inescapable that the enactment of an air law is the first essential step toward the development of commercial aviation in the United States."

The experiences of the inland waterways and the railroads in either burdening themselves with huge terminal debts, or in struggling selfishly for the exclusive control of available sites, a control which meant private monopoly and this, in turn, public burden, point the way for the sound economic treatment of the air port problem. The establishment of common terminals for the encouragement of all aviation, and for the national security in time of need, is a public responsibility, which, if neglected now, will invite difficulties within a few years similar to those in which the waterways and the railways now find themselves.

At the close of 1920, operating reports showed the existence of 128 terminals of all classes, of which five were in Canada, and three others devoted to airship experiment, leaving a net of 120 in the United States. Of this number, probably 20 could be classified as seaplane bases.

At the close of 1921, the operating reports showed a total of 146 air terminals, both land and water, within the United States. All were for heavier-than-air craft. This is an increase of 26 over the preceding year. Of the total number, 30 were classified as seaplane bases. Sixteen of the 146 were publicly owned or controlled.

Deprive the rail and ocean carriers of depots and docks, and operation must cease. Withhold terminals from the American aircraft industry, and aerial transport can achieve neither size nor reliability. The 146 terminals reported available to commercial aircraft in the United States represent the facilities for 600 machines without regard to geographical or business requirements. The wonder is that there has been so much paid flying from so few fields.

In preparing the data for the Department of Commerce, the worst obstacle encountered in research and analysis was the lack of official machinery with which to obtain thorough and authentic information. Two courses were open—confidential data (as to identification) from the established companies making operating reports; and press stories, covering the general field. It is important to state at

this point and to bear continually in mind that the press stories (with the exception of less than half a dozen fatalities) refer wholly to the gypsy flier and thus prove conclusively that the uncontrolled itinerant pilot encounters and causes most of the danger in flying.

One hundred and twenty-five established companies, operating 500 to 600 two and three-place machines, made 130,736 flights, covering 2,907,245 miles and carrying 122,512 passengers in the twelve months, October 1st, 1920–October 1st, 1921. In making their reports, these companies seemed careful to itemize all forced landings, crashes, etc. Yet the number of accidents in which persons were killed or injured, totals but 24.

Six Requisites for Safe Flying

Experience has taught that, in safe flying, there are the following requisites:

1. A machine aerodynamically and structurally sound.
2. An engine of sufficient power and which operates satisfactorily.
3. A competent, conservative pilot and navigator.
4. Air ports and emergency landing fields, sufficiently close together to insure gliding to safety.
5. Nation-wide weather forecasts specialized and adapted to the need of fliers.
6. Nation-wide chart of air routes.

Analysing the causes to which the 24 accidents are attributed: Of the six fatalities, three were due to stunting, two to gross carelessness on the field, and one to storm. Not a single person, passenger or pilot, lost his life in straight commercial flying. And with Federal regulation, controlling stunting and enforcing proper field policing and protection, it is believed certain most of these fatalities would have been avoided.

There were 21 persons injured in the 24 accidents. These mishaps were due to causes which could have been removed by Federal regulation or supervision—had landing fields, air routes and weather reports been fully available; had the field help been more disciplined; had the pilots been more alert through consciousness of licensed responsibility and had there been strict inspection of aircraft, engines, accessories and supplies.

These deficiencies, as compared with the requisites for safe flying, will be more carefully discussed later, when the case of the irresponsible itinerant is taken up, for it is he, rather than the established, incorporated company, that demands control.

122,512 Flew; Not One Killed

Yet, even conceding the foregoing, it is found that during twelve months, 500 to 600 commercial aircraft made 130,736 flights, traveling 2,907,245 miles, carrying 122,512 passengers (men, women and children) without a single fatality in flight.

Out of these 122,512 people, only 21 were injured in flying and in ground accidents, combined, or a ratio of:
0 fatality to 130,736 flights, and 2,907,245 miles flown, and
1 injury to 6,701 flights, and 138,440 miles flown.

The Case of the Gypsy Flier

It is estimated that during the calendar year 1921, 1,200 aircraft were engaged in

civil flying in the United States and that these flew 6,500,000 miles and carried 250,000 persons. These figures are approximate and include both the itinerant and fixed base flying. Many press reports may be inaccurate as to causes, but they afford the only available index into the comparative safety of the total aerial activity.

A survey shows that 114 accidents occurred, not including those that involved Government-owned aircraft. Two of the 114 occurred in January, 1 in February, in March, 6 in April, 16 in May, 13 in June, 13 in July, 28 in August, 16 in September, 8 in October, 8 in November, and 1 in December, progressing and diminishing as the flying season advanced and waned. The accidents were reported from all parts of the United States—30 being in the East, 43 in the Middle West (which has most of the machines and, generally speaking, the best natural landing fields and 41 in the Far West.

What Caused the Accidents

The 114 accidents resulted in death to 49 persons and injury, more or less serious, to 89. In 48 instances there were no casualties. The 49 lives were lost in 3 accidents and injury to the 89 persons was caused in but 42 accidents.

Each of the 114 accidents recorded was caused by deficiency in one or more of the six necessary requisites for safe flying. Forty-nine were attributed to the pilot perhaps through carelessness, perhaps incompetence, perhaps bad judgment combined with other factors. There is no doubt that a good pilot can guide a poor machine to safety with greater chance of success than a poor pilot can operate a first-class craft. Therefore, at the very top of the list of Governmental needs to place the Federal examination and licensing of pilots. During the war rather more than 17,000 young men were trained to fly. The knack of flying cannot be retained perpetually without practice, nor can it be maintained at a high degree of competence without regular examination on a common standard for all flying throughout the United States. The same is true of aerial navigators. Both pilot and navigator (many times they are identical) are of equal importance in safeguarding the lives of travelers by air.

Inadequate Landing Fields

Twenty accidents are attributed in whole or in part to inadequate landing facilities, to the total lack of terminal facilities. Here is a duty directly imposed upon the Federal Government. During the war the Army and Navy acquired many terminals, most of which have since been abandoned. The fragmentary remainder has been slightly added to by the Air Mail, municipalities and private enterprise, but the United States is today woefully lacking in air ports for even the 1,200 craft in operation.

Lack of Weather Reports

While only 4 accidents are attributed to the lack of weather reports and 10 to the lack of clearly defined routes or limitation in traveling between or over cities, it is certain that aerial transport can not develop until these factors are met. As an illustration—two of the worst accidents in our flying history are attributed to the causes. As one was Naval and the other Military, they can not be included in the

vic survey, though in their results they are as harmful to civil flying prospects though they had occurred to private individuals.

On March 2nd, a Naval seaplane, according to press reports, sideslipped on to beach near Pensacola, Fla., and killed five bathers. Either the seaplane had no business over that beach or the bathers had no business on it. In either event, the fatalities would have been prevented had proper authority existed.

On May 28th a large Army plane crashed at Morgantown, Md., killing its seven occupants, who included some of the best-known figures in Military and civil aviation. According to the report of the Inspector General's investigators, the disaster was not due to defects in the machine or to incompetence on the part of the pilot, but to the terrific storm into which the plane flew and of which the pilot had not been warned. The investigators above referred to recommended that "steps should be taken to install a system for interchange of weather conditions and weather forecasts, between flying fields maintained by the various services, including Army, Navy, Mail Service and Coast Guard Service." It was further stated: "Obtaining information of weather conditions on a cross-country flight ranks in importance with the inspection of the engine and plane, and it is highly desirable that, in peacetime, except in emergencies, no cross-country flights should be undertaken until available information of conditions on the way has been obtained."

Commercial cross-country or inter-city flights, it is evident, can not be encouraged with safety until there is full protection afforded by establishing civil weather reports and co-ordinating these with the various Government reports. This service, obviously, can not be provided by the several States.

Inspection an Imperative Need

Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. Out of the 114 accidents, 22 may be attributed to flights which proper inspection probably would have revealed—4 concerning the plane, 9 the engine and 9 an accessory, gear or oil. This inspection must be made at frequent intervals by Federal authority. When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that anyone can take any sort of flying machine into the air at the present time, with the consequent peril not only to himself and his passengers, but to many persons on the ground. If the standard of control were left to the various States, the hope of correcting this unfortunate condition would seem remote.

In one accident attributed to the attempt of the pilot to stunt an unsafe machine, two lives were lost. An investigator reported that the plane was not a factory-maintained product. He said: "It was one of the Army training types which had passed through many owners and which, my investigation shows, had been in at least four crashes previous to the final one. I found that the machine had been repaired by amateurs, that several of the spars and longerons were patched, some of them in four places. It was the giving way of these spars that undoubtedly caused the wings to collapse. The plane blew apart out of doors in the open field all over and one windstorm had blown it the full length of the field—about 1000 yards—and turned it over end. This morning it had been hauled back to its

original position and put together again as best as might be. It was never inspected by a competent person, so far as I was able to learn. I found that the owner of the flying field—who is also a flier—had himself refused to fly this machine when the young man who took it up on its fatal trip was induced to become the pilot."

In the lack of any Governmental examination and inspection, the legitimate manufacturers and operators have endeavored to do what they could. They check up on their products, but their control is of necessity limited to localities and to a comparatively brief period of time. As flying increases, this method must become more hopeless and a stern responsibility is thus placed upon the Federal Government to provide an adequate system of examination and inspection.

Stunting Causes More Than 40% of Deaths and Injuries

Twenty-nine of the 114 accidents occurred during stunting. In these 29 accidents, 20 persons were killed and 36 injured—more than 40 per cent of the total. In other words, stunt flying in unrestricted areas was responsible for almost as many casualties as all other elements combined. Now stunt flying is necessary to testing and essential to warfare. It is believed advisable that all pilots know how to stunt so that, in case of an emergency, when only a stunt will save their craft, they will be able to act quickly, with understanding and without fear. But the habit of stunting for thrill is dangerous, fatal in many instances, and always harmful to civil flying. A Government system of control, limiting stunting to certain areas, will meet this unfortunate menace to aeronautics. In this connection, however, there is hope of general improvement. State Fairs and other amusements, since the war, have encouraged dare-devil flying as "concessions." But after stunts had killed many people and injured more under spectacular circumstances (such as collisions with grandstands, crashes on beaches, etc.) the New York State Fair Commission, according to press reports, eliminated the dare devil aerial acrobat from its list of attractions.

Collision in the Air

The danger of collision in the air is not great, providing levels of flight for aircraft under way are established and observed, and providing stunting is controlled. The 2 collisions reported occurred during stunt performances. In the first, one man was killed, and in the second, 2 were killed and one hurt.

Crowds Surge On to Field

Eight accidents causing injury to 7 persons are reported through carelessness on the field. In several notable instances the pilot, in order to avoid the crowd which surged out in front of his machine as he was taking off or landing, deliberately wrecked his craft. It is observed that at every flying demonstration, even at locally policed fields, the spectators ignore warnings and must be forced to keep back. This is illustrated by the long list of automobile race track casualties, where spectators get in the way. Only Federal rules rigidly enforced are able to meet this condition.

Searching for the "Unknown" Cause

Finally, 8 accidents which caused death to 4 and injury to one, are attributed to "unknown" causes. The hope of preventing accidents depends on learning—then cor-

recting—the cause of each. It is evident that Federal authority is required to obtain information in such cases.

Flying Not Unsafe

From the foregoing it is seen that flying, even with the burden of unnecessary hazard imposed through the lack of an Aerial Code, is not unsafe.

Eliminating those deaths caused by stunt flying (20) and those attributed to lack of fields, weather reports and clearly defined air lines or routes (6) which only Federal authority can correct—23 fatalities remain—or one to about every 12,000 passengers, and one to 282,608 miles of travel,—unlicensed, unregulated and uncontrolled, and carried on for the most part in former war machines built from three to four years ago.

In case of the 125 operating companies, which flew 2,907,245 miles and carried 122,512 passengers on 130,736 flights, not a single fatality occurred in straight commercial activity. And it is from this record rather than from the itinerant picture that the public should judge the safety of travel by air. These companies approximate the condition in equipment and personnel which will be general when the Federal Government recognizes its duty and responsibility.

Furthermore, the aeroplane of 1921, powerful and beautiful as it appeared to us, and as it undoubtedly was in contrast with the gliders of Lilienthal and Chanute and even the Kitty Hawk biplane of the Wrights, will some day be to the ultimate flying machine what the primitive train of 1830 is to the Twentieth Century Limited. The designing and engineering features are progressing. Improvements in safety and efficiency are being constantly introduced. These, if aided by regulation and stimulation by the Government, assure security in the air travel of the near future comparable with that of the accepted means of transportation which we have today on rail, road and water.

Performance of B. M. W. 185-Horsepower Engine

This report by S. W. Sparrow deals with the results of a test made upon a B.M.W. engine in the altitude chamber of the Bureau of Standards, where controlled conditions of temperature and pressure can be made to simulate those of the desired attitude.

A remarkably low value of fuel consumption—0.41 pound per b.h.p. hour—is obtained at 1,200 r.p.m. at an air density of 0.064 pounds per cubic foot and a brake thermal efficiency of 33 per cent. and an indicated efficiency of 37 per cent. at the above speed and density. In spite of the fact that the carburetor adjustment does not permit the air-fuel ratio of maximum economy to be obtained at air densities lower than 0.064, the economy is superior to most engines tested thus far, even at a density (0.03) corresponding to an altitude of 25,000 feet.

The brake mean effective pressure even at full throttle is rather low. Since the weight of much of the engine is governed more by its piston displacement than by the power developed, a decreased mean effective pressure usually necessitates increased weight per horsepower. The altitude performance of this engine is, in general, excellent, and its low fuel consumption is the outstanding feature of merit.

A copy of Report No. 135 may be obtained upon request from the National Advisory Committee for Aeronautics.

RESEARCH PROBLEMS UNDER INVESTIGATION FOR THE SUBCOMMITTEE ON AERODYNAMICS OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

THE following memoranda prepared by the National Advisory Committee for Aeronautics outline the comprehensive character of research work now being done in the United States.

Langley Memorial Aeronautical Laboratory Controllability Testing

This research is intended to provide definite data as to the response of an aeroplane to its control and to lead to the establishment of definite quantitative standards for controllability.

Tail Pressure Distribution

The distribution of pressure on the tail during steady motion, while interesting from an aerodynamic standpoint, tells but little about the loads and stresses arising, since these always reach their maximum value during accelerations. It is therefore desired to extend the work to the securing of a continuous record of the variation of pressure at a large number of points while maneuvering.

Wind Tunnel Tests on Wings

The necessity of this work is obvious, both to develop new sections of improved properties and to compare sections already tested under different conditions.

Similitude Testing (Wind Tunnel)

Tests are being undertaken in order to provide further data on the scale effect for wings of more modern type than the RAF-6, and also in order to determine the largest size of model that can be used in the Langley Field wind tunnel without interference.

Aileron and Rudder Tests

This work has been undertaken to find the relative efficiency of different locations for the aileron and rudder, and the relative effect of ailerons on different forms of wing.

Experiments with New Balances

The present type of N. P. L. balance, has certain serious disadvantages for high-speed work. Although comparatively satisfactory for low speeds, very large sizes in high speeds impose too great a load on the pivot and require too large a spindle to support the model. Experiments leading to the development of a new and improved type of balance should therefore be undertaken.

Tests for Slip-Stream Effect

The effect of slip-stream on the control surface and on the drag must be determined if wind tunnel testing is to be increased in usefulness. This is particularly necessary in connection with the loads on control surfaces.

Pressure Distribution for Thick Aerofoil Sections

The purpose of this research is to determine the variation of loading along the wing span for such wing sections and plan forms as are likely to be used in all-metal internally-braced designs. This research will supply data very much needed in design work.

Comparison of Wing Characteristics in Models and Free Flight

This research has been undertaken to furnish accurate and complete data on which to base performance estimates.

Determination of a Coefficient of Longitudinal Stability

In the course of free-flight research on stability, an attempt is to be made to determine the comparative values of various "coefficients" of longitudinal stability. It would be a great convenience to the designer to know that by a few simple tests there might be obtained a "coefficient" which actually expressed or indicated, longitudinal stability.

Preliminary Tests of Aerofoils in Free Air

The purpose of this investigation is to obtain large values of Reynolds number on tests of wings. This method not only gives the proper Reynolds number, but it also gives a velocity, a size, a degree of turbulence and an unrestricted body of air which is identical with that in which the full-sized aeroplanes fly. From a preliminary test it was estimated that the lift coefficient of any model can be determined to 2 per cent. and the drag to at least 5 per cent.

Small Oscillations in Steady Flight

This investigation has been undertaken to determine the magnitude of the angular oscillations about the three axes of the aeroplane when in steady flight, and also to determine the angular accelerations by differentiating the curves of the oscillations.

Pressure Distribution Over the Rudder and Fin

The purpose of this research is to determine the distribution of load over the rudder and fin both while the aeroplane is in steady flight and when it is being stunted.

Longitudinal Dynamic Stability

This work is a continuation of that already undertaken on static longitudinal stability. The characteristics of a number of different aeroplanes should be determined with a view to checking up the mathematical theory of their oscillations.

Pressure Distribution on Ailerons

Information on the pressures on the ailerons and on the wing surface surrounding them is desired by designers in computing the stress on the rear spar and also the stress on the aileron itself.

Pressure Distribution Over the Wings of an Aeroplane in Accelerated Flight

At the present time we have no data at all as to flow of air or the distribution of load over an aeroplane wing during accelerated flight, and it is quite probable that under such conditions the loading will be quite different from that in uniform flight. For this reason it is considered that careful study of the loading on the wings under conditions of stunting will be of the greatest value to aeroplane designers.

The Complete Study of an Aeroplane Oscillation

The purpose of this investigation is to aid in extending the theory of aeroplane stability.

The Effect of Longitudinal Moment of Inertia on Aeroplane Oscillations

It seems evident from theoretical work that the dynamic stability of an aeroplane will be greatly influenced by the ratio of the mass of the aeroplane to its longitudinal moment of inertia. The purpose of this investigation will be to determine the magnitude of this effect.

Standardization of Wind Tunnels

This investigation is to include the construction and test of a series of standard cylinders, wing-sections, and airship forms for comparison of the results obtained in different wind tunnels. The models are to be made in four different sizes.

Distribution of Loading Between Wings of Biplanes and Triplanes

This research is to be carried out at gap-chord ratios of 0.9, 1.0, 1.1, and 1.2, and with various degrees of stagger for each aerofoil of a series, such as Albatross, RAF-15, USA-1, and USA TS-5 or Göttingen No. 255.

Free Air Tests of Spheres

As it seems fairly certain that the critical values in the resistance of a sphere are a measure of the turbulence in the air, measurements of the resistance of spheres in the free atmosphere are to be made to determine the degree of turbulence, and also to carry the Reynolds number higher than has been done before.

Bureau of Standards (Wind Tunnel)

The Direct Measurement of the Velocity of the Wind Stream in a Wind Tunnel, Independent of Pitot Tube Measurements

Wind speed measurements in wind tunnels at the present time are based entirely upon Pitot tube determinations of wind speed, which in turn are based (1) upon the theoretical head developed in a Pitot tube, or (2) upon calibration of the Pitot tube on a whirling arm which involves corrections for swirl. Other independent measurements of wind speed are desirable.

The Measurement of the Steadiness of the Wind Stream and the Effect of Unsteadiness on the Air Resistance of Models

The purpose of this investigation is to develop methods for measuring quantitatively the unsteadiness in the flow of wind streams, including (1) unsteadiness in distribution, and (2) unsteadiness in time.

The Effect of Turbulence of the Wind Stream on the Resistance of Bodies of Various Shapes and Its Bearing on Scale Corrections

This investigation is undertaken to determine the effect of turbulence in wind streams on the resistance of models.

Bureau of Standards (Aeronautical Instruments Section) The Investigation of the Elastic Properties of Springs for Aneroid Instruments

The purpose of this investigation is to determine the performance characteristics of the Bourbon tubes used in aircraft instruments.

The Investigation of the Elastic Properties and Hysteresis of Diaphragms

The purpose of this investigation is to determine the characteristics of various types of diaphragms used in aircraft instruments for measuring pressures with a view to facilitating the rational selection and design of diaphragm elements for any specified purpose. The investigation is to include flat and

corrugated metal diaphragms, slack diaphragms, and sylphon diaphragms.

The Investigation of the Behavior of Air-Speed Instruments in an Air Stream Under Reduced Pressures

The purpose of this investigation is to determine the performance of air-speed instruments under reduced pressures and at low speeds in order to make possible the more accurate determination of the air speed of aircraft.

Leland Stamford

Air Propeller Research

In this investigation a large number of models previously used in the tests reported on in Reports Nos. 14, 30, and 64, of the National Advisory Committee for Aeronautics are to be examined by means of the aerofoil theory of the propeller, and the results compared with the results of wind tunnel tests on these sections.

SHOWING AN AVIATOR HOW HE FLIES

AFTER nearly twenty years of flying without knowing just how he did it, a man has now conceived a means of recording what an aeroplane pilot does and how the aeroplane responds. Aeroplane designers, builders, owners, instructors and pilots are delighted, though surprised, over the revelations of a method of recording accurately what an aviator does in executing any maneuver in an aeroplane, and also for securing exact data on the performance of an aeroplane in flight. This method has just been devised by the aeronautical experts and pilots of the National Advisory Committee for Aeronautics.

Three special instruments have been perfected to record the speed of the aeroplane in the air, the loadings or changes in weight on the wings, and the movement of the controls by the pilot. Although fairly complicated themselves, the operation of these instruments is simple and mechanical, the recording being done by means of a photographic film. The results reveal for the first time a practical method of securing information on testing new types of aeroplanes, and for determining the ability and technique of a pilot. The last function of the instruments will be of great value to the pilots themselves and to instructors of novices, who are seldom able to recall just what they did with the controls at a certain point of flight.

Three Instruments Record All Moves

The first instrument is an air speed indicator, a device for recording the speed of the aeroplane through the air. A second is used for recording variations in the loading on the wings in flight, and the landing carriage when landing, taking off, while running along the ground. In flying through a loop, for example, the pilot is sitting down hard as he goes up and again as he flattens out, but he is literally hanging in his belt at the top of the loop. It is these variations in load on the wings, due to the weight of the aeroplane and the aviator in the air that are recorded by this instrument and the weight of the carriage while on the ground. The third device, the control-position recorder, indicates the exact position of all the controls during any maneuver, or part of a flight. When the pilot gives his ship left or right it is recorded in degrees, when it dives by pushing on his "stick," or pulls

it back to lift the nose, these movements are shown on the record of the flight. After he lands, there is no argument as to what he did, for it is plotted from an automatic record. If one pilot reported that a certain aeroplane was not controllable, he could be checked up by having another pilot put the aeroplane through the same maneuvers, and then comparing the records of both pilots as delineated by this new instrument.

Instruments Act in Unison

These three instruments are synchronized to operate simultaneously, by means of a timing device which makes possible the coordination of the three records into a composite one available for study and analysis. The instruments themselves are not bulky and they do not interfere with the movements of the pilot or operation of the aeroplane. All the attention they require is the throwing of a switch, before a maneuver is begun and when it is completed, to see them all in operation and to stop them.

When the flight is completed the photographic records with their delineations of the pilot's movements and the aeroplane's performance are taken to a laboratory, greatly enlarged for study, and then plotted on a single sheet so that a complete story of the particular flight or maneuver is ready for analysis.

The instruments developed have been employed at the Committee's free-flight laboratory at Hampton, Va., by Test Pilot Thomas Carroll, in studying ordinary and stunting maneuvers, including looping, rolling, the so-called Immelman turn and reverse turn. An extensive study of landing and taking off also has been made.

In his report on the tests, Pilot Carroll points out the importance of taking off and landing, which are the determining factors of the efficiency, and perhaps longevity, of a pilot. Of the two, he says, landing is perhaps the most important, for it is in this phase that the majority of accidents and damages occur. A paper on taking-off and landing by Major R. M. Hill, a British flying officer, is the only one known to have been published on these important maneuvers, and it was this treatise which inspired the tests and developments undertaken by the National Advisory Committee for Aeronautics in this country.

Keeping Tabs on the Pilot

Application of this research work are seen in designing new aeroplanes based upon performance tests, testing advanced and hitherto untried types, and for study by instructors and pilots themselves. The author states: "It reveals to even the skilled pilot startling facts as to his technique." "It is surprising to the flier," he says, "to see an accurate record of his every movement of the controls in the air and the fluctuation of the loading and air speed which have given him but fleeting impressions while he was in the air." Up to the time of these developments in recording instruments, designers and engineers had to depend upon the memories of the test pilots as to the performance of a particular aeroplane. The pilots' recollections were often vague and they frequently disagreed as to the same aeroplane, due perhaps to the personal equation. Today, however, a review of the finished chart by the flier enables him to recall his actions, the response of the aeroplane, and give a comprehensive report, which frequently adds much to the delineations on the chart.

Hitting a Four and One-Half Ton Blow

In one of his recent tests, Pilot Carroll made an especially bad, or "pancake" landing, by levelling-off about six feet above the field, instead of a foot or so as is usually done, to see what effect on the aeroplane a loss of flying speed at that height would have. The record of the blow in vertical acceleration showed that he hit the ground with a force of $4\frac{1}{2}$ times the weight of the aeroplane, or a total force of about four-and-a-half tons. Strangely enough there were no dire results, except that one of the rubber shock absorbers broke. In careful and regular landings this force seldom exceeds $1\frac{1}{2}$ to 2 times the weight of the aeroplane.

Further developments in perfecting these recording instruments include the addition of a recording device to show the progressive speed or revolutions of the engine, and another device to record the actual force or power the pilot applies to his controls, that is, how many foot pounds he exerts in pulling his stick back or pushing it forward in a particular movement. This, it is said, will indicate whether or not the pilot "drives" with a loose or tight rein, and whether he abuses his controls and the aeroplane itself.

ADVANTAGES OF AERIAL MAIL

Extracts from Address by C. G. Peterson, of the Wright Aeronautical Corporation, Paterson, New Jersey, at a Luncheon of the Engineer's Club and the Flying Club of Baltimore

AS I see the situation, the most helpful sign of the present time for commercial aviation is the attitude of Congress in realizing the necessity of having private contractors carry mail by air. There have been two bills presented on this subject, one by the Honorable Halvor Steenerson, Chairman of the Committee on Post Offices and Post Roads, and one by Honorable M. Clyde Kelly, of Pennsylvania, a member of that committee. Let me quote from a prepared statement given by Mr. Kelly in May: "It has never been the policy of Congress or the Post Office Department to monopolize the carrying of mail matter by aircraft. It is believed that more rapid advancement can be made and more economical service given if private concerns are encouraged to perform this task of transportation." In looking at what can be accomplished by aerial transportation of mail, let us take a concrete example of a proposed air mail route between two cities—New York and Chicago. I will give you some actual figures on the quantity of mail now moving between those cities, the time which can be saved, and the costs of transporting this mail by aeroplane.

There are approximately 25 tons of firstclass mail daily from New York to Chicago. This includes the gateway mail at each end and considerable other mail matter, in addition to letters. There are on an average of 160,000 letters a day collected in New York City for delivery in Chicago City. This quantity does not include gateway mail at either end. The quantity of gateway mail is several times this amount. There are approximately 325,000 letters a day sent from Chicago to New York for delivery in New York City. The figures given are for letters and firstclass mail, and do not include other classes of mail of which there is a tremendous volume.

I will show you in detail from charts prepared from the present actual train schedules the time and quantity flow of this mail between New York and Chicago. These charts also include the lay-over time between the arrival of the train and the delivery. On these charts we have shown a mail plane "flight" paralleling each of the principal mail trains. It must be noted in this connection that the time of arrival and departure of most of these trains has not been set for the convenience of the Post Office Department, whereas if mail planes are operated their time of departure can be scheduled to meet the postal requirements.

WESTBOUND

Train No. 43, the newspaper train, with three 60 foot R. P. O. cars and 5 storage cars, leaves New York at 2:10 A. M., arrives in Chicago 24 hours afterward, and its mail is delivered in Chicago at 9 A. M. of the second day, over 31 hours after it leaves New York.

Flight No. 1 will leave New York at 2 A. M., arriving in Chicago at noon for delivery downtown by 2 P. M., saving one business day on 42,000 letters.

Train No. 19 with one 60 foot R. P. O. car and one storage car leaves New York at 5:31 P. M., arriving in Chicago the next afternoon at 4 P. M., too late for delivery that afternoon, and the mail is delivered in Chicago 9 o'clock the following morning 40½ hours after it leaves New York.

Flight No. 3 will take the mail from train No. 19 at Erie, flying it to Chicago, to arrive at noon for distribution by 2 o'clock that afternoon, saving one business day on 42,000 letters.

Train No. 35, is a very heavy letter train, leaving New York at 8:40 P. M., with one 60 feet R. P. O. car and 5½ storage cars, arriving in Chicago at 8 o'clock the next morning. Its mail lays over until the next morning and is delivered 35 hours after leaving New York.

Flight No. 5 will leave New York at 8 P. M., arriving in Chicago at 6 A. M., for the first delivery in the morning, advancing 42,000 letters one business day.

Flight No. 7 is an additional plane leaving New York at the same time but carrying mail for West of Chicago. Flight No. 7 arrives in Chicago at 6 A. M. By using additional planes out of Chicago connecting with Flight No. 7, the mail can be flown to arrive in St. Louis at 10 A. M., to be delivered by noon—to arrive in St. Paul at 11 A. M., to be delivered by 2 P. M.—and to arrive as far West as Kansas City by noon, to be delivered by 2 P. M., saving one business day on 42,000 letters.

Train No. 93 leaves New York at 9:26 A. M., carrying one 60 foot R. P. O. car as far as Cleveland where it arrives at 4:35 the next morning for delivery approximately 24 hours after it leaves for New York.

Flight No. 9 leaves New York at 6 A. M., arriving in

Cleveland at noon for delivery by 2 P. M., saving one business day on 42,000 letters.

EASTBOUND

Train No. 32 with one R. P. O. car and four storage cars leaves Chicago at 1:50 A. M., arriving in New York 26 hours later, and its mail is delivered at 9 A. M. of the second day over 30 hours after it leaves Chicago.

Flight No. 2 will fly from Chicago at 3 A. M., arriving in New York at noon with 42,000 letters to be delivered downtown by 2 P. M., saving one business day on 42,000 letters.

Train No. 22 with one R. P. O. car leaves Chicago at 5:30 P. M., arriving in New York at 5:25 P. M., too late for delivery and its mail is delivered 9 A. M. of the second day over 38 hours after it leaves Chicago.

Flight No. 4 will fly from Erie at 6 A. M., with the New York mail taken from Train No. 22 which passes through Erie at 5:15, and Flight No. 2 will arrive at New York at 10 A. M. to be delivered downtown by noon, saving one business day on 42,000 letters.

Flight No. 6 will fly from Chicago at 12 o'clock midnight with the mail for Buffalo, Rochester, Syracuse, which has missed train No. 22 at 5:30 P. M. Flight No. 6 will arrive at Erie at 4:30 A. M., transferring its mail to train No. 2 which arrives in Syracuse at 10:45 A. M. for delivery at noon, saving one business day on 42,000 letters.

Train No. 28 with three R. P. O. cars carrying the heavy letter mail leaves Chicago at 11:15 P. M., arriving in New York at 7:15 A. M. of the second day, distributing its mail over 32 hours after it leaves Chicago.

Flight No. 8 flies from Chicago at 11 P. M., arriving in New York at 8 A. M. the next morning for distribution 10 hours after leaving Chicago, saving one business day on 42,000 letters.

Flight No. 10 is to forward mail flown from cities west of Chicago. This mail could be flown by air leaving Kansas City at 6:30 P. M., leaving St. Paul-Minneapolis at 7:00 P. M., leaving St. Louis at 8 P. M., leaving Chicago at 11:00 P. M., arriving in New York at 8 A. M., the next morning with 42,000 letters advanced one business day.

Three routes are being investigated by our corporation for a flight from New York to Chicago. We are making an analysis of the weather conditions, the possibility of selecting good emergency landing fields, and the probability of density of traffic along these three alternative routes.

The first route is along the Southern boundary of New York State through Binghamton, Elmira, Erie and Cleveland to Chicago. The second route is the present mail route through Bellefonte to Cleveland and Chicago. The third alternative route is somewhat longer but present data indicates that throughout all year around weather conditions will be considerably better. This route is known as the Southern Pennsylvania route through Reading, Harrisburg, Pittsburgh, Columbus, Dayton and Indianapolis to Chicago. If this Southern Pennsylvania route is selected as a trunk airway for a New York-Chicago flight, the logical point of connection from Baltimore and Washington would be at Harrisburg, which has been selected as the probable location for a radio control station. It will probably be about an hour's flight from Baltimore and Washington to Harrisburg, so the westbound mail from Baltimore and Washington could be dispatched later than the time of the flights leaving New York. On Eastbound mail, the mail from Baltimore and Washington could be flown from Harrisburg and arrive in Baltimore and Washington before the arrival of the through flights in New York.

These charts and the figures given show the actual time which can be saved by flying the mail, and give an idea of the quantity now being dispatched. The cost is the next important item, and in general since we have compiled these detailed figures we have been surprised at the moderate cost of such service. We have based these costs on the contractor being able to make a four years contract with the Post Office Department. We have figured on the contractor establishing the aids to navigation required. We have figured on the contractor leasing an emergency landing field at every 18 or 20 miles along the route. At each landing field there will be a powerful Beacon light, an illuminated sign, flood lights for landing, and an illuminated indicator giving the direction and velocity of the wind. At approximately every 150 miles we have figured on the contractor establishing a radio communication station. Each plane will be equipped with a combined radio telephone and telegraph set. An automatic sender on the

plane will telegraph at short intervals the plane identification number. The two radio compass stations between which the plane is flying will chart the position of the plane from these intermittent signals. If the pilot should get off the course he will send an automatic message to the nearest radio compass station. The compass station will telephone to him the compass course to follow and the distance to get back on the course. By this method the pilot will not need to receive telegraphic messages, as the instructions will be sent to him by telephone. Furthermore, he will not need to use his telephone except when he desires. This leaves his attention undivided for maneuvering his plane except when he desires information. We have figures on divisional points with shops and hangars approximately every 250 miles. At these divisional points the mail will be transferred to a fresh plane, fully serviced, and a fresh pilot.

Inasmuch as a trunk air line from New York to Chicago, equipped for day and night flying, will spell the success or postponement of commercial aviation in this country, we consider it advisable for the radio compass stations and the divisional points to be under the control of the contractor so there may be no division of responsibility. We have figured on the contractor using new modern planes which will carry at least 1,000 pounds of mail, with a cruising speed of 100 miles per hour, and a high speed of 20 or 25 miles faster. We estimate that the cost of operating this service, based on a four years contract, flying four planes Eastbound and four planes Westbound daily will be approximately \$1,863,000 per year. The four Eastbound planes will expedite 210,000 letters a day, and the four Westbound planes another 210,000 letters a day, or saving a business day on 420,000 letters a day. Flying on 310 business days a year would mean 130,000,000 letters per year, and the cost would be less than 1½ cents per letter. This works out that the total cost per mile flown is about \$1.00, which is at the rate of one mill per mile per pound.

Now the figures that I have given above indicate what can be reasonably expected in the future. But it must be remembered that in organizing as long a line as this, it will be inexpedient for either the contractor or the Post Office Department to undertake a contract of such magnitude as four planes each way daily. We have therefore prepared alternative figures on flying one plane each day each way. In making up this estimate we have left in all the costs of all the aids to navigation given in the larger estimate, including emergency landing fields, Beacon lights, and radio compass stations, so that the costs given will cover day and night flying. We estimate that flying one plane each way each day between New York and Chicago will cost approximately \$800,000 a

year based on a four year contract. Based on a 1,000 pound load, the \$800,000 yearly cost, plus 5%, gives a rate of 1¾ mills per mile per pound or 4¼ cents per mile per cubic foot of cockpit mail space in a plane. On this basis of one round trip per day approximately 25,000,000 letters would be expedited yearly from New York right through to Chicago, and the cost per letter, \$800,000 divided by 25,000,000 letters, would be a little over 3 cents per letter, that is if all the mail is *through* mail. If the flight is arranged so that *way* mail can be carried either between intermediate cities or advancing part of the mail from trains which had already carried it some of the distance, approximately 50,000,000 letters per year could be expedited, and the cost would be only about 1 6/10 cents per letter.

Let me quote again from Congressman Kelly, who says: "While the payment for the transportation by aircraft would practically equal the revenues, that fact should not be conclusive argument against the plan, when it is realized that the rural mail carrier receives two cents for every letter, paper or parcel delivered, more than the entire revenue received by the Post Office Department. It is believed a worthy project to continue the rural mail delivery for the promotion of the common welfare."

Another point to be considered is that both bills introduced by Chairman Steenerson and Congressman Kelly call for an increased rate of postage when the sender desires to make use of the air mail. Both bills, however, would allow the Postmaster General to send other mail in order to make up the full capacity of the plane. The use of this additional postage could be expected to grow rapidly and thus cut down the net cost to the Government. It must also be remembered that in preparing the costs of aerial mail, we have not deducted the present cost of transportation by rail. These detailed figures show that the cost of yearly operation is not excessive for the saving of a business day on millions of letters.

Both of the bills now before Congress give a maximum rate per pound per mile above which the Postmaster General will not be allowed to contract for. Unfortunately, the rates given in both bills are too low. Mr. Kelly says of his bill: "This measure has been approved by the Postmaster General with the provision that the rate should be changed to 2 mills per pound per mile." We are heartily in accord with the desirability of either of these bills being passed with a rate of 2 mills per mile per pound, or its equivalent space rate of 5 cents per mile per cubic foot of mail compartment in the plane. The Post Office Department can be depended upon to make their bargains with contractors at or below these rates to protect the interests of the people.

It is urged in view of the promotion of the common welfare which can be accomplished by saving a business day on business letters from the Eastern seaboard to the middle West, and a corresponding saving on letters to the extreme West, that the Engineer's Club and the Flying Club of Baltimore both officially make known to the Post Office Committee of the House and their representatives in the House and in the Senate, their desire as citizens of Baltimore for the passage of the bill to allow the mail to be flown and at rates of remuneration for the contractor which will allow him to establish a safe, efficient, and dependable service.

Baltimore Flying Meet

THE Aeronautical Chamber of Commerce is co-operating with the Flying Club of Baltimore in arranging a flying meet to be held in Baltimore on May 30th. The program embraces some interesting events calling for participation by commercial machines.

Approximately \$1,300 to \$1,500 in prizes are being arranged. The meet has the support of the local Baltimore civic organizations and particularly of the National Guard. The following is the tentative program:

1. Efficiency Contest Conditions

1. Having useful load (including fuel) of more than 750 lbs.
2. Contest decided on formula — $E = \frac{w-t}{g}$
S—speed over course in m.p.h.
w—total weight loaded.
t—tare, weight of machine empty plus oil and water.
g—fuel consumption in gallons over course.
3. Course, Logan Field, to Filtration Plant, to Bay Shore Park, to Logan Field, one circuit 15.4 miles. Entrants will make 4 circuits. Time to be taken from initial to final crossing of Logan Field. Machines off at 1 minute intervals.
4. Prizes: First, \$500. Second, \$200. Third, \$100.

2. Race for Military Planes Conditions

1. Handicaps.
D. H., time over course X 1:00, official time.

cial time.

S. E., time over course X .92, official time.

Fokker D. VII, time over course X .92, official time.

Vought 180 H.P., time over course, X 1:00, official time.

2. Course—Same as (1)—2 laps. Time, taken from initial crossing of Logan Field. Machine sent off—1 minute interval.

3. Precision Flying National Guard Pilots Conditions

1. Pilots shall climb to 3,000 ft., throttle motor and spiral down, landing at circle. Pilots will be allowed to "jazz" motors in very short bursts, three times for purpose of clearing motor. Pilots should endeavor to make maximum number of spirals and pull up at a minimum distance from center of circle.
2. Formula for determining winner:
$$E = \frac{N}{D}$$

N—number of spirals made. D—distance in feet from mark.
3. Pilot will, after landing, wait for judge to mark position of center of circle on ground, and will then taxi in to line, clearing way for landing ships. Judge will immediately measure distance from mark.

4. Sport Plane Efficiency Contest Conditions

1. Pilots will take off and indulge in any acrobatics such as loops, rolls, spins

not under 500 ft., examples of slow flying and slow landings, which the pilot decides will show the value of his ship.

2. Efficiency of performance to be determined by 3 judges.
3. Any pilot stunting under 500 ft. or over crowd will be disqualified for any further participation in meet.
4. Prizes: First, \$250. Second, \$150. Third, \$100.

5. Bombing of Fort Carroll by U. S. Air Service Pilots Conditions

1. Pilots will bomb a silhouette of Fort Carroll with smoke bombs from altitude of 3,000 feet, using 25 lb. smoke or including bombs.
2. Details to be decided by U. S. Air Service and Aeronautical Chamber of Commerce.

6. Balloon Sniping Contest, National Guard Officers Conditions

1. Pilot and observer, latter with pump gun loaded with small shot will climb to 2,000 feet, when at this altitude, three balloons of approximately 2 feet diameter will be released at 1 minute interval. The observer who shoots down these balloons in shorter time, wins.

7. General Flying and Demonstration of Commercial Planes

Commercial planes are allowed to carry passengers and give any demonstrations they desire. Commercial planes who desire to carry passengers for pay during meet may do so, except during events Nos. 3 and 5.

LANDING FIELDS IN THE UNITED STATES

Long Island

Gravesend Bay.—Latitude 40° 34' N., longitude 74° 00' W.

Fair grounds; near Coney Island; mile track; ideal.

New Dorp.—Latitude 40° 34' N., longitude 74° 06' W.

No data.

Plum Island.—Latitude 41° 10' N., longitude 72° 12' W.

Fort Terry Parade Ground; across Long Island Sound.

Sayville.—Latitude 40° 45' N., longitude 73° 05' W.

Emergency field; Sayville radio towers near.

Sottinghamton.—Latitude 40° 54' N., longitude 72° 25' W.

Emergency; near beach, also at West Hampton.

Westbury.—Latitude 40° 45' N., longitude 73° 35' W.

Roosevelt Field; the best on Long Island; 3,000 feet square; four hangars.

Woodbury.—Latitude 40° 50' N., longitude 73° 26' W.

Webb Field; old Government field; ideal.

North Carolina

Bellhaven.—Latitude 35° 32' N., longitude 75° 37' W.

Seaplanes; no data.

Columbia.—Latitude 35° 55' N., longitude 76° 14' W.

Seaplanes; no data.

Danville.—Latitude 36° 01' N., longitude 79° 36' W.

Emergency field, on hilltop.

Edenton.—Latitude 36° 04' N., longitude 76° 35' W.

Seaplanes only; no data.

Elizabeth City.—Latitude 36° 18' N., longitude 76° 13' W.

Seaplanes only; no data.

Hamlet.—Latitude 34° 55' N., longitude 79° 39' W.

Emergency fields in open country around.

Hertford.—Latitude 36° 11' N., longitude 76° 28' W.

Seaplanes only; no data.

Kinston.—Latitude 35° 15' N., longitude 77° 34' W.

Hill Field; 500 by 1,000 feet; south of river; north of railroad.

Monroe.—Latitude 35° 00' N., longitude 80° 32' W.

Reported by the National Aircraft Underwriters' Association; no data.

Newbern.—Latitude 35° 06' N., longitude 77° 02' W.

Field of the Acme Film Co.; 150 by 700 feet; good when wet.

Oriental.—Latitude 35° 02' N., longitude 76° 41' W.

Seaplanes; no data.

Plymouth.—Latitude 35° 52' N., longitude 76° 44' W.

Seaplanes; no data.

Swan Quarter.—Latitude 35° 25' N., longitude 76° 20' W.

Seaplanes only; no data.

Washington.—Latitude 35° 33' N., longitude 77° 03' W.

Seaplanes only; no data.

Wrightsville Beach.—Latitude 34° 12' N., longitude 77° 48' W.

Seaplanes only; no data.

Ohio

Alliance.—Latitude 40° 55' N., longitude 81° 06' W.

Country Club; emergency field.

Canton.—Latitude 40° 48' N., longitude 81° 22' W.

Real Estate Company Field; 800 by 1,500 feet; bordered by streets.

Findlay.—Latitude 41° 03' N., longitude 83° 37' W.

Emergency; near old fair grounds; 1,000 by 3,000 feet; ideal.

Fremont.—Latitude 41° 20' N., longitude 83° 06' W.

Christy Farm Field; 700 by 1,200 feet; ideal.

Hamilton.—Latitude 39° 23' N., longitude 84° 32' W.

Emergency; fair grounds.

Irononton.—Latitude 38° 31' N., longitude 82° 40' W.

Field of the Rafusa Flyers (Inc.); flying instruction.

Kenton.—Latitude 40° 38' N., longitude 83° 36' W.

Emergency; fair grounds; ½-mile track.

London.—Latitude 39° 53' N., longitude 83° 26' W.

Field of the London Aero Club (Inc.), 1,500 feet square; hangar; supplies.

Ravenna.—Latitude 41° 10' N., longitude 81° 15' W.

Willard Brady Field; 750 by 1,200 feet.

Steubenville.—Latitude 40° 22' N., longitude 80° 35' W.

Emergency; country club; 1,800 by 300 feet.

Youngstown.—Latitude 41° 06' N., longitude 80° 37' W.

Olds Farm Field; 1,400 by 1,600 feet; near country club; ideal.

Zanesville.—Latitude 39° 57' N., longitude 82° 00' W.

Emergency; 900 by 650 feet; also ½-mile track.

Oklahoma

Altus.—Latitude 34° 38' N., longitude 99° 15' W.

80 acres; square; wheat stubble; near edge of town; altitude 1,500 feet.

Alva.—Latitude 36° 50' N., longitude 98° 45' W.

Emergency.

Anadarko.—Latitude 35° 04' N., longitude 99° 15' W.

Fair grounds track; 500 by 1,000 feet; good.

Arapaho.—Latitude 35° 32' N., longitude 99° 01' W.

Black Farm Field; 350 by 1,000 feet; good; altitude 1,500 feet.

El Reno.—Latitude 35° 30' N., longitude 97° 58' W.

Emergency; between city and country club; 48 acres; square; soft when wet.

Medford.—Latitude 36° 50' N., longitude 97° 43' W.

Field of the Grand Amusement Co.; 1,200 feet square; ideal.

Stigler.—Latitude 35° 15' N., longitude 95° 06' W.

Municipal field; 1,200 feet square; fair grounds; good when wet.

Oregon

La Grande.—Latitude 45° 20' N., longitude 118° 07' W.

Municipal; 320 acres near race track; ideal; good when wet.

Marshfield.—Latitude 43° 22' N., longitude 124° 12' W.

Municipal; 1,000 by 500 feet; good when wet; oil tanks north and south.

Pennsylvania

Bethlehem.—Latitude 40° 37' N., longitude 75° 23' W.

Emergency; 1,000 by 1,500 feet; 4 miles south of town.

Dauphin.—Latitude 40° 23' N., longitude 76° 57' W.

Emergency; 50 acres.

Hatboro.—Latitude 40° 10' N., longitude 75° 06' W.

Commercial; 16 miles north of town along York Road.

Irwin.—Latitude 40° 21' N., longitude 79° 41' W.

Field of the Irwin Aircraft Corporation; 20 miles east of Pittsburgh; hangar.

Mechanicsburg.—Latitude 40° 13' N., longitude 77° 03' W.

Municipal; 30 acres.

Williamsport.—Latitude 41° 17' N., longitude 71° 04' W.

McCormic Motor Car Co.'s Field; 100 acres, along river; hangar.

Rhode Island

Pawtucket.—Latitude 41° 54' N., longitude 71° 22' W.

Emergency; no data.

Quonsett.—Latitude 41° 35' N., longitude 71° 25' W.

Emergency; state property; on bay, unlimited space.

Sandy Point.—Latitude 41° 40' N., longitude 71° 25' W.

Emergency; 5 miles east of Greenwich.

South Carolina

Beaufort.—Latitude 32° 36' N., longitude 80° 40' W.

Seaplanes only; no data.

Ducwest.—Latitude 34° 20' N., longitude 82° 24' W.

Aerial mail station; experimental station.

Georgetown.—Latitude 32° 22' N., longitude 79° 17' W.

Seaplanes only; no data.

South Dakota

Tyndall.—Latitude 43° 00' N., longitude 97° 51' W.

Field of the Tyndall Aeroplane Co. 1,000 by 1,200 feet; hangar with circle on roof; good when wet.

Tennessee

Clarksdale (Memphis).—Latitude 35° 09' N., longitude 90° 00' W.

Field of the Memphis Aerial Co., near country club; hangars, etc.

Jellico.—Latitude 36° 36' N., longitude 84° 09' W.

Municipal; 60 acres; ideal; hangar etc.

Texas

Blockners Ranch.—Latitude N., longitude W.

Near Rio Grande River; used by border patrol pilots.

Bracketville.—Latitude 29° 17' N., longitude 100° 18' W.

For Clark Drill Grounds; 4,000 feet square; ideal; good when wet.

Brenham.—Latitude 30° 10' N., longitude 96° 21' W.

Stone Meadow; 40 acres; ideal, good when wet; marker, hangar, etc.

Herne.—Latitude 30° 51' N., longitude 96° 31' W.

Elite Field; 35 acres, triangular; ideal, good when wet; hilly country.

Kernah.—Latitude 29° 32' N., longitude 95° 01' W.

Roberts Field; 1,600 by 1,800 feet; ideal; good when wet; east of creek.

Sabinal.—Latitude 29° 16' N., longitude 92° 26' W.

Emergency; ideal; good when wet; ¾ mile square.

San Diego.—Latitude 27° 45' N., longitude 98° 14' W.

Emergency; no data.

San Ygnacio.—Latitude 27° 00' N., longitude 99° 19' W.

Emergency; no data.

Taylor.—Latitude 30° 32' N., longitude 97° 24' W.

Turner Pasture; emergency; 1,600 feet square; ¾ mile southwest of town.

Yokum.—Latitude 29° 17' N., longitude 97° 10' W.

Emergency; on edge of town; 600 by 1,500 feet; along road; ideal.

Utah

Henefer.—Latitude 41° 01' N., longitude 111° 30' W.

Northwest of Coalville; emergency field.

Vermont

Brattleboro.—Latitude 42° 51' N., longitude 72° 07' W.

Emergency; good; marked with 100-foot circle.

St. Johnsbury.—Latitude 44° 26' N., longitude 72° 01' W. Emergency; along river.

Virginia

Cape Charles.—Latitude 37° 07' N., longitude 75° 58' W.

Seaplanes only; no data.

Washington

Everett.—Latitude 47° 58' N., longitude 122° 11' W.

Emergency; no data.

Kennecick.—Latitude 46° 13' N., longitude 119° 07' W.

Kelso Field.—Latitude 46° 09' N., longitude 122° 55' E.

Municipal; 160 acres; ideal; hangar, marker, etc.

White Bluffs.—Latitude 46° 45' N., longitude 119° 28' W.

Field of the Yakima Aviation Company; on Yakima to Spokane route.

West Virginia

Buffalo.—Latitude 44° 29' N., longitude 81° 13' W.

Aero Club Field; aerial taxi lines.

Huntington.—Latitude 38° 26' N., longitude 82° 27' W.

Commercial Flying Field.

Wisconsin

Alma.—Latitude 44° 18' N., longitude 91° 52' W.

Emergency; good fields on Minnesota side of river.

Buffalo.—Latitude 43° 45' N., longitude 89° 29' W.

Good cross country field.

Green Bay.—Latitude 44° 29' N., longitude 88° 01' W.

Aero Club Field; 1½ miles west along Fox River; 750 by 2,500 feet; ideal; good when wet; hangar and marker; seaplanes use river ½ mile away.

Minong.—Latitude 46° 07' N., longitude 91° 48' W.

Emergency; marked.

Pheasant Branch.—Latitude 43° 06' N., longitude 89° 36' W.

Good emergency field along railroad.

Stevens Point.—Latitude 44° 30' N., longitude 89° 32' W.

Fair grounds; ½ mile track.

Wyoming

Buffalo.—Latitude 44° 20' N., longitude 106° 40' W.

Emergency field; reported by the West Aero Corporation of Casper.

Casper.—Latitude 42° 51' N., longitude 106° 20' W.

Field of the Western Aero and Motor Corporation; Curtiss distributors; good when wet; hangar and supplies; altitude 5,400 feet.

Elk Mountain.—Latitude 41° 45' N., longitude 106° 22' W.

Emergency field; broad plains.

Greybull.—Latitude 44° 30' N., longitude 108° 03' W.

Emergency; no data.

Lander.—Latitude 42° 50' N., longitude 108° 42' W.

Emergency; no data.

Riverton.—Latitude 44° 02' N., longitude 108° 22' W.

Emergency; no data.

Shoshoni.—Latitude 43° 13' N., longitude 108° 06' W.

Emergency; no data.

Thermopolis.—Latitude 43° 40' N., longitude 108° 13' W.

Emergency; no data.

Worland.—Latitude 44° 02' N., longitude 108° 58' W.

Emergency; no data.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, March, 1922

DIVISION	Gas	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchman	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
														Callons of Gas	Total Time Run Hr., Min.	Total Miles Run	Cost per Hour	Cost per Mile
EASTERN New York-Chicago.....	\$3,378.04	\$676.86	\$2,735.29	\$2,641.56	\$836.67	\$1,000.31	\$2,983.22	\$1,407.47	\$4,069.78	\$3,363.70	\$1,667.55	\$754.88	\$25,515.33	11,805	414 52	38,500	\$61.48	\$0.66
CENTRAL Chicago-Springfield.....	5,149.65	1,057.91	8,944.24	2,238.42	859.45	752.37	3,341.61	2,038.41	6,002.17	7,100.47	2,415.07	1,093.26	40,993.03	18,560	755 52	68,920	54.22	.59
WESTERN Chicago-Springfield-Francisco.....	3,307.78	614.30	5,348.38	2,220.17	1,317.57	736.51	3,273.91	1,407.48	4,529.26	4,198.80	1,667.54	754.88	29,376.58	11,167	468 36	43,244	62.70	.68
Alaska and Territories.....	\$11,835.47	\$2,349.07	\$17,027.91	\$7,100.15	\$3,013.69	\$2,489.19	\$9,598.74	\$4,853.36	\$14,601.21	\$14,662.97	\$5,750.16	\$2,603.02	\$95,884.94	41,532	1,640 20	150,664	\$58.35	\$0.64

Total Operating Cost.....\$95,884.94
Permanent Improvements.....614.04
Grand Total.....\$96,498.98

COST PER MILE			
Division	Overhead	Flying	Maintenance
Eastern.....	\$0.19	\$0.21	\$0.26
Central.....	.12	.18	.29
Western.....	.18	.20	.30
Entire Service.....	\$0.16	\$0.19	\$0.29

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio.

Flying consists of: Gas; Grease and Oil; Pilots.

Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories; Warehouse.

PAUL HENDERSON, Second Assistant Postmaster-General.



FOREIGN NEWS



BRITISH SAFETY FUEL TANK AWARDS

The British Air Ministry announces: The prizes in the Air Ministry Competition for Safety Fuel Tanks for aircraft have been awarded as follows:

First Prize—£1,400. The India-Rubber, Gutta Percha and Telegraph Works Company, Limited, Silvertown, London, E. 16.
Second Prize—£400. Imber Anti-Fire Tanks, Limited, West Road, Tottenham, London, N. 17.
Third Prize—£200. Commander F. L. M. Boothby, (R. N. Retired), "Overway," Tilford, Surrey.

The Competition was arranged in order to promote the evolution of a reliable type of fuel tank for Service and Commercial aircraft, which would reduce the risk of fire, due to crashing or hostile action, to a minimum.

Twenty-six entries were received for the Competition, which was open to the world, and eighteen different types of tanks were actually submitted for test.

The Judges appointed by the Air Council consider that the competition has resulted in the achievement of the objects for which it was instituted and has produced a type of safety fuel tank which, although capable of improvement in several minor respects, is available for immediate introduction on Service and Civil aircraft and which, for a slight increase in weight over and above that of the standard Service steel tank, gives almost complete immunity from fire, either in a crash or in action with enemy machines.

All the tanks tested, with a few exceptions, showed marked superiority in almost every respect over the standard Service steel tank now generally in use.

The Judges were: Group Captain E. F. Briggs, (Deputy Director of Research); Major B. C. Carter (Directorate on Research); Major J. H. Ledebor (Directorate of Research); Mr. G. Cockburn (Accidents Investigation Branch); Major J. P. C. Cooper (Accidents Investigation Branch); Mr. H. Grinstead (Royal Aircraft Establishment).

The regulations governing the competition provided that each entrant had to submit two tanks for preliminary trials and that the three most successful competitors in the first stage should submit four more tanks for final trial.

Description of Winning Tanks

Details of the tanks submitted by the three winning competitors for the preliminary tests are as follows:

Tanks Submitted by Messrs. India-Rubber & Gutta Percha Co., Ltd., Silvertown, London

	No. 1	No. 2
Weight of tank	78.75 lbs.	81.25 lbs.
Capacity of tank	37.7 gals.	38.2 gals.
Weight of gallon capacity .....	.58 lbs.	.66 lbs.
Shape of tank	Cubical	

Each consisted of a welded sheet steel rectangular tank with no frame or baffles or any sort, but with each side slightly dished inwards, inserted in a detachable rubber case.

These tanks were slung in the fuselage by means of webbing.

Tanks Submitted by Messrs. Imber Anti-fire Tanks, Ltd., Tottenham, London

	No. 1	No. 2
Weight of tank	50 lbs.	51.5 lbs.
Capacity of tank	30 gals.	29.3 gals.
Weight per gallon capacity	1.66 lbs	1.76 lbs
Shape of tank	Elliptical	

The tank consisted of a light gauge tinned steel shell which was separated from the inside by a framework of aluminium tubing and light gauge aluminium baffle plates. After assembly the whole of the tank had been covered with india-rubber of a suitable thickness, and all joints vulcanized.

Tanks Submitted by Commander Boothby, Tilford, Surrey

	No. 1	No. 2
Weight of tank	33.23 lbs.	35.75 lbs.
Capacity of tank	58 lbs.	66 lbs.
Weight per gallon capacity	56.8 gals	53.7 gals.
Shape of tank	Cubical	

The tank consisted of an inner bag of 4-ply rubbered fabric capable of containing the petrol with an outer cover of rubbered fabric which was gas-tight. Non-inflammable gas was introduced into the space between the two shells and maintained under slight pressure. A drain pipe was fitted to the outer casing. The tank was fixed to the fuselage by rubber shock absorber and stringing and encased in 3-ply glued on.

Modifications for Final Tests

The three competitors qualifying for the final tests were required to submit four tanks of a type fundamentally similar to those entered for the preliminary trials, any minor modifications which it was desired to incorporate being previously submitted for the consideration and approval of the Judges Committee. This resulted in the following departures being made with the consent of the judges.

1. Messrs. The India-Rubber Co. incorporated the following modification:

- The metal of the fuel container was reduced from 20G to 26G.
- The capacity was reduced to within the prescribed limits.
- The tanks were internally coated with a lead deposit.
- Light gauge baffle plates were introduced.
- The method of attachment of the flap to the opening in the rubber cover was slightly modified.
- The attachment to the fuselage altered in detail but not principle.

2. Messrs. The Imber Anti-Fire Tanks Ltd., introduced compressed rubber buffers at the front of the tank and in place of metal straps and turnbuckles for fixing the end cradles, used leather thong.

3. Commander Boothby substituted a 3-ply outer casing in lieu of the outer fabric shell and was requested by the Committee to reduce the capacity of the fuel container proper to agree with the terms of the regulations.

Details of these modified tanks are as follows:

Tanks Submitted by Messrs. India-Rubber, Gutta Percha & Telegraph Works Co., Ltd.

	No. 1	No. 2	No. 3	No. 4
Weight of tank	57 lbs.	54.5 lbs.	57 lbs.	54.5 lbs.
Capacity of tank	29 gals.	29 gals.	29 gals.	28.8 gals.
Weight per gal. capacity	1.96 lbs.	1.88 lbs.	1.96 lbs.	1.89 lbs.
Shape of tank	Cubical			

Tanks Submitted by Messrs. Imber Anti-fire Tanks, Ltd.

	No. 1	No. 2	No. 3	No. 4
Weight of tank	52.5 lbs.	51.5 lbs.	50.5 lbs.	51.5 lbs.
Capacity of tank	30 gals.	29.7 gals.	29.7 gals.	29.7 gals.
Weight per gal. capacity	1.73 lbs.	1.73 lbs.	1.70 lbs.	1.75 lbs.
Shape of tank	Elliptical			

Tanks Submitted by Commander Boothby

	No. 1	No. 2	No. 3	No. 4
Weight of tank	36.5 lbs.	35.5 lbs.	33 lbs.	35.5 lbs.
Capacity of tank	31.5 gals.	31.5 gals.	31.5 gals.	31.5 gals.
Weight per gal. capacity	1.16 lbs.	1.13 lbs.	1.05 lbs.	1.13 lbs.
Shape of tank	Cubical			

Method of Testing

The method of testing the tanks in the preliminary trials was as follows:

Each tank was mounted in a wooden structure similar in construction to the fore part of the ordinary tractor small type aircraft. The concrete body formed to represent an engine was mounted in front of the tank. The structure containing tank and engine was released down an "T" section girder runway approximately 100 ft. high, arranged that the body struck the ground at an angle of approximately 45° to the horizontal. It was originally intended to crash the structure on a concrete bed. It was, however, found necessary to modify the conditions and the bed was covered with a 2'6" depth of sand. The conditions then briefly were those of the typical aircraft crash, the engine partially burying itself, the tank coming into violent contact with the engine. As, however, the fuselage structure at the moment of impact had attained a velocity—allowing for friction and air resistance—of approximately 50 m. p. h. the conditions were more severe than would prevail in a crash from which a human being could hope to escape with his life. The test was intentionally made thus severe in order definitely to reveal weakness or bad points in design.

In the final trials the following tests were imposed:

Two tanks of each type were submitted to acceleration and crash tests and the remaining two to firing tests, the acceleration test being arranged to imposed stresses approximately equivalent to four times that due to gravity.

The tanks mounted in the fuselage structure were fixed to a pendulum raised to the requisite height and released by a trip gear.

A tank of each type submitted to this test was given two swings, and was then placed on one side for 10 to 15 minutes at the end of which, from outside examination, nothing untoward had occurred.

The crashing tests were carried out in a similar manner to that adopted for the Preliminary Tests with the exception that flints were substituted for sand on the crashing bed.

The tanks submitted to firing test were mounted to their fuselage structures and subjected to bursts of five rounds of Vickers machine gun fire, composed as follows:

1 Armor piercing, 1 incendiary, 2 armor piercing, 1 incendiary.

Judging

A system of judging was adopted whereby each judge was enabled to record an independent opinion on a common basis. For the preliminary tests this system was on the following basis:

As regards weight, the basis of 100 marks was taken as representing a tank, which, complete with fittings, conformed to the specified weight of 1.75 lbs. per gallon capacity.

For each variation of a decimal point of this weight capacity ratio 6 marks were added or deducted from the 100 marks.

In addition, as a means of correction in the case of tanks whose capacity was outside stipulated limits, the following formula was adopted.

Marks X Required Capacity

Actual Capacity.

Tanks received marks for the attributes in the following proportions:

(a) Crash-proof qualities 100 marks maximum

(b) Remaining attributes 100 marks maximum

(c) was divided up as follows:

Durability under Service conditions in the absence of accidents 25 marks

Indifference to extremes of temperature 25 marks

Adaptability of design to large capacities 10 marks

Simplicity of construction 10 marks

Adaptability of design to various shapes 10 marks

Accessibility of fittings 10 marks

Cost of production 10 marks

In awarding marks for the various attributes stated above, the ordinary mild steel service tank was taken as a standard.

This resulted in the following competitors being placed in the order named at the end of the Preliminary Tests:

1st. Commander F. L. M. Boothby; 2nd Messrs. Imber Anti-Fire Tanks Ltd.; 3rd India-Rubber, Gutta Percha & Telegraph Works Co., Ltd.

In the final tests the marking was made on the following basis:

100 marks maximum for each crash test 2

100 marks maximum for each firing test 2

100 marks maximum for remaining attributes 1

Total 5

The final result was:

1st, India-Rubber & Gutta Percha Co.; 2nd, Imber Anti-Fire Tanks Ltd.

3rd. Commander Boothby.

Each of these designs showed marked superiority in almost every respect to the standard service steel tank.

Other Tanks

Description of the unsuccessful tanks are appended below:

Tanks Submitted by Messrs. Beasley, Simms & Merris, 33, St. John's Road, Langley, Nr. Birmingham

	No. 1	No. 2
Weight of tank	78.5 lbs.	73.5 lbs.
Capacity of tank	35.6 gals.	34.8 gals.
Weight per gallon capacity	2.21 lbs.	2.11 lbs.
Shape of tank	Cylindrical	Cylindrical

These tanks were cylindrical and of all-metal construction. They consisted of a petrol-tight outer case containing an inner case with perforated ends, in two separate halves, suspended from flanges on outer case by means of very stiff compression springs.

The tanks were slung between cross pieces at each end which were connected together by longitudinal tie rods, clips being used to secure the whole to the fuselage.

Tanks Submitted by Mr. Bengtsson, 53, Ilford Hill, Ilford, Essex

	No. 1	No. 2
Weight of tank	80.75 lbs.	83.25 lbs.
Capacity of tank	33.8 gals.	33.5 gals.
Weight per gallon capacity	2.39 lbs.	2.49 lbs.
Shape of tank	Rectangular	

This tank consisted of two parts. The fuel container and an outside shell, the space between being filled with sheet cork.

Tanks Submitted by Mr. Bramson, Facture, Gironde, France

	No. 1	No. 2
Weight of tank	60 lbs.	62 lbs.
Capacity of tank	38.2 gals.	36.1 gals.
Weight per gallon capacity	1.57 lbs.	1.71 lbs.
Shape of tank	Cubical	

These tanks were provided with but one outlet and one inlet connection and were of a very complicated construction; they had an inner compartment consisting of a duralumin frame covered with petrol-proof-doped silk over which was a layer of rubber "Caoutchouc mousse," which is a material of the sorbo-sponge type, but with very minute cells not in communication with one another; the rubber, therefore, was not porous. To ensure that if pierced the hole would seal up, this rubber was fitted under lateral compression and was held in place by a very fine mesh wire gauze.

This inner receptacle was slung in a metal framework by means of a wire net which was anchored to what eventually would be the four rear corners, another cover of fabric, caoutchouc-mousse, and a final one of fabric completed the tank. The last cover of fabric caoutchouc-fabric was kept a small distance away from the inner container by means of thin strips of wood, the space being utilized for CO₂ under pressure which is communicated to the inner portion of the tank by means of a small hole at the top.

The whole was mounted on four bearers which sat on the fuselage frame and were lashed in place by means of shock absorber elastic so as to allow a possible movement of approximately 4".

Tanks Submitted by Mr. Brooke, 9, Parkside Terrace, Cullingworth, Nr. Bradford

	No. 1	No. 2
Weight of tank	64.5 lbs.	61.25 lbs.
Capacity of tank	37.2 gals.	Due to leak from damage, capacity could not be taken.
Weight per gallon capacity	1.73 lbs.	
Shape of tank	Cubical	

The tanks were constructed with a rectangular inner metal tank built round a tubular framework and placed in the outer case, the surrounding space being packed with sheep's wool. Outside the other case was another layer of sheep's wool and around the whole were wound two layers of fine iron wire. The inner framework was also bound in each direction by iron wire. The tank was held in place by five tension springs on each of four corners.

Tanks Submitted by Mr. Delaunay, 4 Rue Piedfort, Le Havre, France

	No. 1	No. 2
Weight of tank	107.5 lbs.	Received in
Capacity of tank	31.6 gals.	badly damaged condition and not tested
Weight per gallon capacity	3.4 lbs.	
Shape of tank	Cubical	

The construction was similar to that submitted by Mr. Bengtsson, being a rectangular inner metal tank and outer case, with the intervening space packed with cork—see photograph 4685. This tank had but two connections, an inlet on top and an outlet at the bottom.

Tanks Submitted by Mr. Dickinson, Torquay House, West Cross Lane, Swansea

	No. 1	No. 2
Weight of tank	92.5 lbs.	
Capacity of tank	43.1 gals.	
Weight per gallon capacity	2.15 lbs.	
Shape of tank	Cubical	

This tank consisted of an inner and outer tank, there being an air space of 1 1/4" between the two. This space was filled with lightly packed absorbent cotton and a chemical solution.

Tanks Submitted by Mr. Gibson, 16, Dyke Parade, Cork

	No. 1	No. 2
Weight of tank	50.8 lbs.	51 lbs.
Capacity of tank	30.9 gals.	30.9 gals.
Weight per gallon capacity	1.65 lbs.	1.65 lbs.
Shape of tank	Barrel-shaped	

These tanks were barrel-shaped and of all-metal construction; they were made of but one casing with two ordinary baffles and two truncated conical baffles, the base of each pointing to the end of the tank nearest to the small end joined to the two ordinary baffles.

Tanks Submitted by Captain Goeta, Instituto Sperimentale Aeronomico, 8 Lungtevere, Michelangelo, Rome

	No. 1	No. 2
Weight of tank	51 lbs.	57 lbs.
Capacity of tank	30.1 gals.	31.1 gals.
Weight per gallon capacity	1.69 lbs.	1.83 lbs.
Shape of tank	Cylindrical	

They consisted of an inner tank of four separate compartments and an outer tank, the intervening space being filled with CO₂ or exhaust gas under pressure, approximately 3 lbs. per square inch. The four compartments were intercommunicable by means of special non-return valves which, in the event of a crash, were intended to shut off any broken

compartment from the others. A small hole joined the outer space with the inner spaces, so enabling the petrol to be put under pressure.

Tanks Submitted by Mr. Hobbs, 268, High Road, Wood Green, London

	No. 1	No. 2
Weight of tank	75.5 lbs.	78.5 lbs.
Capacity of tank	40.4 gals.	51.4 gals.
Weight per gallon capacity	1.87 lbs.	1.53 lbs.
Shape of tank	Cubical	

These tanks consisted of an inner tank surrounded by cotton wool round which was wound a quantity of ordinary small mesh wire netting, more cotton wool, a netting of strengthening straps and the whole enclosed within a metal cover and more strengthening straps.

Tanks Submitted by Mr. Osborne, Fredensburg, Hammers Lane, Mill Hills

	No. 1	No. 2
Weight of tank	69 lbs.	69.25 lbs.
Capacity of tank	29.9 gals.	29.6 gals.
Weight per gallon capacity	2.32 lbs.	2.34 lbs.
Shape of tank	Cylindrical	

The tank was made of celluloid fitted with celluloid cage and baffle plates and strengthened with special celluloid girder work. It was enclosed in a specially built-up 3-ply cork container, which was then again enclosed in a special vulcanized india-rubber jointless cover.

Tanks Submitted by Mr. Penfold, c/o Sir John Jackson, Ltd., 53, Victoria Street, London

	No. 1	No. 2
Weight of tank	93.5 lbs.	99.5 lbs.
Capacity of tank	30.5 gals.	32 gals.
Weight per gallon capacity	3.06 lbs.	3.1 lbs.
Shape of tank	Cubical	

Each tank consisted of a rectangular welded aluminium container, the sides and back of which were corrugated, placed in a wire cage and tightly packed with asbestos fibre, and around the whole was an outer metal casing.

Tanks Submitted by Mr. Roberts, 32A, Mander Street, Wolverhampton

	No. 1	No. 2
Weight of tank	72 lbs.	72 lbs.
Capacity of tank	27.1 gals.	27.1 gals.
Weight per gallon capacity	2.65 lbs.	2.65 lbs.
Shape of tank	Cylindrical	

Each of the compartments of which the tank was constructed opened into a central tube within which was placed a liner capable of being turned so as to shut off the several compartments when the machine is descending in flames, so that in the event of a crash the fuel which is in the broken compartment only will leak and not the whole. The fuel container was enclosed in an outer shell, a liquid fire extinguisher being introduced between the two.

Tanks Submitted by Mr. Verhoeven, 118, Montignis, Chatilenaux, Belgium

	No. 1	No. 2
Weight of tank	127.5 lbs.	124.5 lbs.
Capacity of tank	39.5 gals.	38.4 gals.
Weight per gallon capacity	3.23 lbs.	3.24 lbs.
Shape of tank	Cubical	

The tank consisted of inner and outer metal shells the space of approximately 1 1/4" between the two being packed with sheet cork.

The Giant Farman

The world's greatest biplane has just finished its final tests in the aerodrome at Orly and soon will commence trans-European flights. Probably it will be used in a new attempt to cross the Atlantic late this summer. It is of Farman construction, with four propellers and four 400-horsepower motors. The wing spread is more than 100 feet.

According to Aviator Boussotrot, its pilot, it will maintain a speed of 100 miles an hour while carrying twenty passengers and baggage—a total load in excess of seven tons. Although it was designed for passenger service, experts who examined it during the recent *salon d'aviation* declared it to be an ideal craft for bombarding cities from a great height in the event of another war.

Portuguese Airmen to Continue Flight

The Portuguese aviators, Cpts. Saccadura and Coutinho, sailed May 9 from Rio Janeiro for St. Paul Rock from Fernando Noronha on board the Portuguese cruiser Republic.

The airmen took with them their new seaplane sent from Portugal on the steamship Bage, which was unable to land the machine at the Rocks because of rough weather, bringing it on to Fernando Noronha. They expect shortly to resume their flight from Portugal to Brazil, cut short by the accident to their first seaplane in landing at St. Paul Rock last month.

Continental Air Couriers

The latest development in aviation is contained in an announcement that an Air Courier Service has just been put into operation between London and Paris. Mr. Ransley S. Thacker, a barrister who has for several years been interested in aviation work, is the one responsible for this new enterprise.

Mr. Thacker travels every other day by aeroplane to Paris, and returns in the same way next day. Shortly he may go to Paris and return on the same day. If the amount of business makes it necessary, and Mr. Thacker states that from his present experience it soon will be necessary, he will employ other couriers, who will be despatched by each of four daily services.

Mr. Thacker is prepared to transact business or to execute commissions of any reasonable nature, and we can imagine many and varied will be the missions which he will be asked to undertake.

Mr. Thacker's offices at Granville House, Arundel Street, Strand, are open day and night, so that instructions may for urgent reasons be made at any time during the night, and in order to develop this service to the full special night flying services will, it is proposed, later on be in operation; and in a short time it is hoped to have a Courier Air Service to Amsterdam, with connections to Berlin and Copenhagen, and also to Brussels, a direct service of couriers between London and Marseilles, and from Paris it will be possible to reach the most remote points by air.

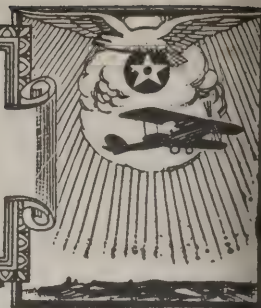
The personal nature of this service is its *raison d'être*, and the commercial and legal experience and negotiating ability of its founder should be most valuable assets.

Mr. Thacker's charges vary from six guineas to ten guineas according to the nature of the transaction involved, but in any case it is considerably lower than the cost of sending one's own messenger.

It is shortly intended to open up offices in Paris, so that the business on that side may be developed also.



NAVAL *and* MILITARY AERONAUTICS



A. S. O. A. Sixth Corps Area

Short talks on the problems of the Air Service in the next war and the types of aeroplanes that are being developed to meet these problems were given at the May meeting of the Air Service Officers Association of the Sixth Corps Area, in Chicago. The problems were presented by Lieut. K. T. Price, A. S. O. R. C., and the descriptions of the machines and instruments now being developed were given by Lieut. Dallas M. Speer, A. S. O. R. C.

Following their remarks Major W. S. Wood of the regular army spoke for some minutes on Customs of the Service, and the necessity of maintaining a high degree of discipline. He emphasized the importance of insistence on a smart military salute as a big factor in maintaining discipline and morale.

Air Service Offers Opportunity

How can I become an Airship and Balloon Pilot and at the same time obtain a commission in the U. S. Army Reserve Corps? No doubt many young men, recently graduated from College or about to obtain the coveted sheepskin this coming year, would be interested in such a proposition and would be glad to grasp the opportunity if they knew it existed. There does exist such an opportunity and it is not limited to college men alone, but in many instances, where a man is possessed of a good High School education, the curriculum of which includes sufficient mathematics and science, he may, upon satisfying the Examining Board as to his qualifications, be admitted to the Air Service Balloon School as a cadet and candidate for a Reserve Commission.

The Army Air Service has established schools for the training of Airship Pilots and Balloon observers. The object of these schools is threefold, first: to provide an adequate Officers Reserve Corps; second: to educate the young men of modern times in Aeronautics, past and present, and the possibilities of aeronautics in the future; and, last, but by no means least:—to promote the science of commercial aeronautics. This last object will have a far reaching benefit if it is carried out as contemplated. Even at the present time commercial aeronautics has become a leading economic factor in some countries, and this country has far greater possibilities, due to the government monopoly which the Army Air Service has on the Helium supply in the United States.

The question may here be interposed, "Why should this have any bearing on the possibilities of Airships?" Helium is a non-inflammable gas known to exist in the southwest part of the United States, particularly in Texas. Although, admitting the highly inflammable character of Hydrogen Gas, there have been very few Airships destroyed, the cause of which can be traced either directly or indirectly to Hydrogen. Nevertheless, the known characteristics of this gas had at least a moral effect on the promotion of Commercial Aeronautics which the discovery of Helium alone can eliminate.

Extensive investigations have been carried on to determine the extent of Helium

resources and considerable money expended to develop the equipment necessary to place this gas on a production basis.

A maximum monthly production of Helium is now possible, amounting to approximately 1,000,000 cu. ft., and it is safe to predict that future production as required is assured.

Some of the recently designed ships have a lift of between fifty (50) and seventy (70) tons, over all, or over the weight of the ship itself. The use of Helium will make ships of this type practically as safe for transportation as the present over-land express. A line of ships of this type from New York to Chicago, to St. Louis, to Omaha, to Salt Lake, to San Francisco is not a mere possibility, but within, say, ten years, it will more than likely be an actual fact. The airship today is in the same category as the automobile of 1905, and how many automobiles were seen on the streets in those days? Those who have prepared themselves for the situation will find ample opportunity for utilizing their knowledge when the airship takes its place among the approved modes of transportation, and upon them will fall the responsibility of success or failure of commercial aeronautics, and to them will go the rewards when success is finally achieved.

It is impossible, in the brief space allotted, to go into all the possibilities of the airship. All that can be expected is to arouse your interest in this all-important subject to the extent that you will not let it rest without further investigating its possibilities and deciding whether or not the predictions are logical: for those who agree that they are, the Government offers a course of instruction leading to a Reserve Commission at the Balloon School, Ross Field, California.

The course at this school covers a period about of ten (10) months, and includes primary training in Airships. An advanced course in Airship work is offered at Langley Field, Virginia, for those who complete the Balloon Observers' and Primary Airship course at Ross Field. This advanced Airship course covers a period of about six months, and when the cadet graduates he is competent to handle any Airship in this country at the present time. This advanced course at Langley Field is not necessary to qualify for a Reserve Commission as it is given on completion of the Balloon Observers' Course. While retaining a Reserve Commission in the Air Service, the qualified Pilot may, as the opportunity presents itself, continue his flying training by taking periodical flights in the craft he is eligible to pilot.

Cadets are paid at the rate of \$75.00 a month, exclusive of board, lodging and clothing. Applicants are desired between the ages of 20 and 25, preferably not over 30, and unmarried.

The 103rd Division

Progress in the organization of the 103rd Division, Air Service, has been fairly rapid considering conditions. Other Air Service units will be organized later. They will come under the head of "Army Troops." Names and qualifications are now being considered and set aside for the 436th

Pursuit Squadron, Pueblo, Colorado; 437th Pursuit Squadron, Deming, New Mexico; 438th Pursuit Squadron, Santa Fe, New Mexico, and 439th Observation Squadron, Phoenix, Arizona. No Corps Air Service troops or lighter-than-air units have been allocated in this divisional area.

A keen interest in Air Service activities exists among reserve officers. All that have been interviewed are anxious to get hold of the "old stick" again and make inquiries as to the possibilities of a fifteen-day training period. Some of them have shown enough interest to write their Congressmen in Washington urging them to make sufficient appropriation for the Reserve Training Camp and to sustain the four million dollar appropriation.

Captain Charles A. Pursley, Air Service, was assigned to duty with the 103rd Division, Air Service (8th Corps Area) with station at Colorado Springs, Colorado. Two rooms in the Federal Building at Colorado Springs are set aside for the headquarters of this Division.

Captain Pursley, in his endeavor to obtain a suitable flying field at Colorado Springs or in the immediate vicinity, has invited recommendations as to a site from the Chamber of Commerce, civic organizations and citizens of the community. He has already inaugurated a publicity campaign.

Further Tests of MB-7

Pilots at Mitchel Field had the pleasure during the week ending April 15th, of watching the little Thomas-Morse Monoplane MB-7 make test flights. Lieut. Flier, U. S. Marine Corps, the pilot, put the little ship over a measured course. The time for the flight has not been officially given out and the speed is not known. The pilot estimated, however, that the little plane made well over 19 miles per hour. This ship is a monoplane with a wing spread of only 16 feet, i powered with a 300 h. p. Wright motor and consequently has a very high landing speed. Thus far the pilot has successfully flown the monoplane on numerous occasions without the slightest mishap.

Reserve Officers Visit Kelly Field

Reserve officers from all branches of the service visited Kelly Field on April 7th in charge of Major Thomas Duncan and Lieut. W. A. Morris. This party about sixty in all, witnessed the formation of DH's and XBIA's. Major Reynolds, commanding officer of Kelly Field, guided the party down the line, describing each event that took place. Much interest was exhibited in the GAX and its possibilities. An exhibition flight in this plane was made by Captain Shea to demonstrate the psychological effect of a low, harassment plan on ground troops. All left with a feeling that such a plane would be rather disturbing.

April Flying Record at Carlstrom Field

Records of the Flying Office at Carlstrom Field show a total of 2,439 hours and 50 minutes flying time for the month of April, 1922. This time was flown in the following type ships: JN-4-6 Curtiss DH4B, Vought, Spad, Thomas Morse and Nieuport.

ELEMENTARY AERONAUTICS and MODEL NOTES

The Design of Model Propellers

An outline of the practices of the Illinois Model Aero Club

THE propellers on a model aeroplane transform the energy stored in the rubber into mechanical energy for overcoming the drift or the resistance of the machine as it passes through the air. The amount of thrust given by the propellers has very little effect upon the speed of the model as the formula, $speed = (weight \% \div surface \times Ky)^{1/2}$, will show. The excess in thrust, i. e., the thrust that is not directly used in overcoming the drift of the model, forces it to climb. As Ky or the lift coefficient of a given model wing varies but very little during its flight, the speed of a given model is nearly constant throughout its flight, the excess in thrust at the beginning causing a quick rise then, providing, of course, the model is properly powered.

The area of the model wing should be reckoned from the speed of the propellers rather than vice versa. The frame and propellers should be first built and assembled; then as much rubber put on the frame as it will stand for all-around flying. And remember a flying model is not doing its best unless the frame is loaded till just below the breaking point with rubber.)

Then the rubber should be wound full and the average R.P.M. until the rubber is about one-half unwound taken. This used in the formula $R.P.M. \times Pitch \times 60 \div 12 \times 60 \times 100 = 8$ (total weight divided by x or the unknown area in square feet) $1/2$ will give the area needed for the propellers used.

The aim in the design of a model propeller should be efficiency. Up to a certain extent, with all other things equal, the larger the propeller the more efficient it will be, for the end loss grows relatively smaller as the propeller grows larger, and also the larger propeller is not so likely to be working in air disturbed by a previous revolution.

Unfortunately, however, there are some serious limitations as to the size of model propellers. They cannot be too large on a twin-push or the frame will be so wide that the efficiency gained by propeller design will be lost in the inefficient angle of thrust. Slight overlapping of the circles described by the propeller blades on a twin-push is advisable, but must not be overdone. In a hydro, the larger the propeller the higher the machine must set from the water, and the hydro model that is set high above the water is not likely to be a record breaker. In this connection a four-bladed propeller, while a hard thing to construct and not efficient unless of a high pitch, has nevertheless made an efficient model.

For the same reason that propellers should be large, the blades should be narrow and the same limitations prevail. The tips, where possible, should be narrow with the widest part of the blade about 65% of the distance to the tips. Sweeping tips are advisable except that such tips usually split easily.

In the securing of efficiency the blades of a propeller must have a true or constant pitch; that is, the pitch must at any point on either blade be the same, for when the propeller turns around every part of the blade should have a tendency to go forward exactly the same distance. To make this possible, the angle of a blade must become greater and greater as the hub is approached, reaching an angle of 90 degrees at that spot, for as the blades turn about the tips travel through a larger circle than points nearer the hub and such points must go forward at proportionately greater angle to keep in pace, so to speak, with the outer part of the blade.

In a carved propeller there are several ways of getting a true pitch, but the easiest and most satisfactory is to carve the propeller from what is known as a Wright blank, patterned from the original Wright aeroplane propeller.

That the pitch of a propeller carved from such a blank would be true and constant can be easily shown. The formula for calculating pitch, taking the measurements from either end of a blank, is, $pitch = \phi D$ (thickness divided by the width). When if the pitch is true P must equal the same thing for any point on either blade. Let X be the distance of any spot from the center, then the pitch at that spot would be $pitch = \phi(D - 2X)$ (thickness $\div (W - D - 2X)$). Putting the values for P equal to each other, then, $\phi D T / W = \phi(D - 2X) T \div (W - D - 2X X / D)$, which, being an identity, shows that a propeller carved from a Wright blank will have a true helical pitch.

However, if the builder wishes to construct a bentwood propeller, then the pitch must be made constant by a different method. Finding the correct angle at a number of spots on each blade by means of a geometrical construction is perhaps the easiest method. The proper angles once found are transferred to the propeller by means of templates.

It must not be understood that either of the above methods will give an absolutely true pitch in practice. Only an approximation to a true pitch can practically be obtained because of variations of the lift and drift coefficients, i. e., parts of the blade nearest the hub which revolve at a high angle are less efficient than the part farther out which revolves at a lower angle. Some of this departure from the helical can be obviated by increasing the depth of the section as the hub is approached, which is usually done anyway to obtain the desired strength.

The size of the propeller to be used on a given model should be estimated from the size and strength of the frame. On a twin-push the propeller should be as large as the frame permits with a slight overlapping. On a tractor the diameter of the propeller is left to the discretion of the builder. The pitch of the propeller on a twin-push is usually about $1\frac{1}{2}$ times the diameter, and a little less on a tractor, although this is largely left to the choice of the builder. Some model builders always carry two sets of propellers with them for each model, one set having wide blades and the other set having narrow blades, while the pitch and diameter are about the same; this allows them to make the most of the existing conditions at the flying field.

As has been stated, the pitch of a propeller can be found from the dimensions of the block from which the propeller was carved by means of the obviously true formula: $pitch = \phi D$. ($T \div W$). In laying out a blank from which to construct a propeller, a certain pitch is usually desired, as is the diameter and width (for whether narrow or wide blades are desired should have been previously decided). Then the thickness alone is lacking. Transposing, we obtain: $T = \phi D W$.

Of the general methods of constructing propellers, i. e., carving and bending, carving is the method now in vogue, although the British have had some sensational success with the other method.

The Illinois Model Aero Club

By Joseph Lucas

The Illinois Model Aero Club was founded during January, 1912, to popularize and study the science and art of aviation through model aeroplanes. This organization was one of the first model aeroplane clubs to be organized in the world, and it has advanced steadily while many other similar organizations formed later have fallen by the wayside. At present it is in its ninth year of successful operation.

Since the first model contests were held early in 1912 up until the present time the club has progressed until it now holds nine of the ten world's records recognized for models of the rubber-driven type. In addition to holding these records the club is the permanent owner of the Villard Trophy as a result of having won the National Model Aeroplane Competition three consecutive times. This competition consisted of a series of contests each year in which clubs from all over this country were entered. Practically all of the individual prizes, as well as the Villard Trophy, were won by members of this club.

From these facts it is easily seen that the Illinois Model Aero Club has been very successful in its work, and it is desired to continue this success by helping all who are interested in model flying or in aviation in general, and by popularizing this game throughout the world. It must be brought to as high a standard as possible and gain that high degree of respect and consideration which it deserves. There never was a mechanical field which held so much fascination for boys, not even the wireless craze, that model building and flying has not surpassed. There can be no doubt that all its effects are beneficial, not only to the brains and hands of the model builder but to those leaders in the aviation world who welcome suggestions by model experimenters.



RADIO DIGEST



Radio Tells Aircraft Altitude

The uses to which wireless is being put on aircraft apart from ordinary communication are yearly becoming more impressive. The latest idea is to use wireless for informing the aeroplane pilot of his exact height above the ground.

Two methods are under consideration. The first makes use of the noise of the engine, which is caught in a series of microphones on the ground, enabling the height of the machine to be ascertained and transmitted to the pilot by wireless. In the second use is made of a proximeter, acting upon the principle that when electrical oscillations are set up in a circuit the frequency of these oscillations depends upon the electrical capacity and inductance of the circuit.

Radio to Join Five Countries

On returning from the International Radio Conference yesterday Edward J. Nally disclosed the fact that a new radio service that will link five nations together was one result of the gatherings in Cannes, Paris and later in London.

The conferences were carried on under the auspices of the Commercial Radio International Committee, and this agreement has been made between representatives of companies of England, France, Germany, United States and South America.

The new circuit will be operated in New York, Paris, London, Berlin and Buenos Aires. Mr. Nally, who is the president of the Radio Corporation of America, came back on the steamship *Homer* after several weeks abroad attending the conferences. He told *The Evening World* that many important questions affecting the development and operation of wireless were considered and satisfactorily settled; in particular, the questions dealing with the extension and development of worldwide telegraph and telephonic communication.

The first of these new international services will be in Argentina, where a super-powered station is now in course of construction and which will be completed soon. It will be located near Buenos Aires and will be capable of transmitting and receiving simultaneously with the stations to be erected in this city, Paris, London and Berlin.

Another conference will be held by technical experts of committee in Berlin late in June to conclude the worldwide connection of other countries by wireless.

Mr. Nally said that the people in Europe are intensely interested in the development of the radiophone and broadcasting service in the United States. Owing to existing laws their many difficulties will have to be overcome by several of the governments before broadcasting is done on the same broad plane as in the United States.

Progress Rapid in Sea Radio

There has been a great change in the mode of communication to and from steamships through the radiophone discovery. The first transatlantic steamship upon which a wireless telegraph apparatus was installed was the *St. Louis* of the American line. It was installed by Guglielmo Marconi, the inventor, who super-

intended the work from the top deck in November, 1899, when the *St. Louis* was making her fifty-second voyage eastward toward Southampton. Communication with the English shore was established when the vessel was sixty-six miles from the Needles. Today great wireless towers are able to flash messages half way around the world by telegraph and every modern steamship is equipped with both the wireless telegraph and telephone apparatus.

Some of the larger vessels are enabled to receive messages in the telegraph code from a distance equal to the width of the Atlantic, but for sending their transmitters will not carry so far. However, with the present telegraph system, a traveler during a transatlantic voyage may communicate with the shore at any time that other ships are willing to relay messages.

That this same system may be further embellished by the radio telephone is now the hope of the various big broadcasting companies who are making the tests with both incoming and outgoing steamships and at the same time making history.

A Warning to All Radio Phone Fans

If you are a radiophone fan—and if you aren't you must be the man Bob Davis once described as "the most extinct of his species"—if you are one of the growing thousands who get companionship, knowledge and recreation out of the little black box, be prepared for an explosion. While you are about it better get prepared for a lot of explosions. They'll be coming along with the first hot weather, says Ernst F. W. Alexanderson, chief engineer of the Radio Corporation of America, in an article, "The Imp in the Radio Box," in *Collier's Weekly* for May 13. He warns that these explosions will raise so much ruckus that the radiophone owners switching in for their nightly concert will feel "as if they had been put into a steel tank against which a husky regiment of boys was throwing tons of everything, from buckshot to paving stones."

These explosions, Mr. Alexanderson explains, are first cousin to the lightning. Their other name is static. Mr. Alexanderson writes:

"This summer the new owners of radio apparatus will have to learn the fact which amateurs have long known—that their sets will give only about half normal service during hot weather. It will depend a good deal on the location of the receivers with reference to the sending stations. Those within about twenty miles of the broadcasting centers should be able to hear signals and conversation and music most of the time, though often with a background of rumbles and cracks. Those farther away will hear proportionately less. It will be seldom indeed that it will be possible to receive from stations several hundred miles away, as has been done by many during the winter. This is true of radio receivers of all kinds. The static imp plays no favorites."

But there are ways to beat the static imp. One is to run a straight wire about 400 yards long (which corresponds with the radio broadcasting wave length) in the general direction of the station from which signals are to come. If you cannot command such magnificent distances for your

aerial you can rig up one of the "loon" type—a long wire wound several times around a vertical wheel, and turn the rim of the wheel toward the sending station. Much can be accomplished also in eliminating static by sharp turning.

Most of us, Mr. Alexanderson says, will have to wait for cold weather to come again before we are real happy with our radiophones, but he promises that by the time another summer comes around the radio experts will have made a big advance toward the solution of radio's biggest present problem.

Radio Set Acts as Barometer

Many experienced radio enthusiasts are able to predict, with a fair degree of accuracy, the advent of cloudy or rainy weather. When the static in the air is particularly heavy, which is evidenced by a loud hissing sound in your receivers you may be quite sure that bad weather is close at hand. This may be observed on small crystal sets as well as on more elaborate apparatus.

Europe Interested in U. S. Radio Progress

The people of Great Britain and the countries of Europe are viewing with great interest the strides made by the United States in the use of the radiophone and are preparing to develop the newest wireless invention on a similar scale, according to Edward J. Nally, who is president of the Radio Corporation of America and who returned to the United States from abroad this week.

Broadcasting will encounter a number of difficulties in Europe which have not faced the pioneers in the United States. Mr. Nally said, because of the small size of some of the nations, the varying languages and laws of restriction which may be made in respect to sending messages across national boundaries. Great Britain has already started broadcasting, however as have France and Germany. The latter country has already established an extensive financial and general news service which is being broadcasted to a number of places in Holland, Denmark and other of the smaller neighboring countries.

"The people of the European countries," said Mr. Nally, "are extremely interested in the reports being published there of the surprising development and extension of the radiophone in the United States, and are preparing to deal with it. Owing to existing laws there are many difficulties to overcome in the way of limiting regulations and restrictions with probable interference among the several countries, however."

Mr. Nally attended the conferences of the Commercial Radio International Committee, which were held in Cannes, Paris and later in London. Representatives of the Radio Corporation of America, the *Compagnie Generale de Telegraphie sans Fils* of France, the *Gesellschaft für Drahtlose Telegraphie* M. B. H. of Germany, and Marconi's Wireless Telegraphy Company, Ltd., of Berlin.

The head of the Radio Corporation said that plans were under way for the immediate construction of wireless stations in a number of localities, particularly in South America. Through agreement between the four companies of the Inter-

tional committee service for commercial purpose was to be improved materially in the near future. One of the large stations is already in the process of construction in Argentine and will transmit and receive from similar places in New York, Paris, Berlin, and London.

"The conference," said Mr. Nally, "considered the extension and development of wireless communication generally and it was agreed that, in order that commercial wireless telegraphy and telephony should be developed to the best advantage in the interests of the public and of international commerce, in the construction of wireless stations every care must be taken to avoid interference. It was decided that the four companies shall not erect and will not erect with favor the erection by others of any stations which will entail the radiation of harmonics or secondary waves beyond the agreed distance outside the limits of the definite wave bands allotted to each particular station."

Business Men Form National Radio Council

A National Radio Chamber of Commerce has been organized for the purpose of remedying some conditions which have arisen in the radio industry as an inevitable result of the over-rapid growth of the industry in the past months and to group together manufacturers whose radio products are of such dependable character as to maintain favorable public opinion toward the radio industry.

It is stated that eligibility to membership will depend, not on the size of a concern, but rather upon the quality of the product manufactured. The original group consisted of about fifteen manufacturers. New members will be added to this body by invitation, to the number of about twenty additional concerns whose business standing and products are known to be of a high order. The quality of the products of candidates for membership will be determined upon by a board of members.

The Radio Chamber of Commerce plans shortly to organize a Credit Bureau for the interchange of credit information.

At a meeting recently held in New York plans were outlined and the following officers elected:

President, Alex Eisemann of the Freed-Eisemann Radio Corporation; first vice-president, Charles Keator of the De Forest Radio Telephone and Telegraph Company; second vice-president, William Dubilier of the Dubilier Condenser Company; secretary, Frank Hinners of the Home Radio Corporation, and treasurer, Joseph R. Freed of the Freed-Eisemann Radio Corporation.

Women Form Radio League

The Women's Radio League of America, Inc., held its first annual meeting on Tuesday evening, May 2, in room 907 Y. C. A. Building, Fifty-third street and Lexington avenue.

The following officers were elected: President, Miss Abbie Morrison; vice-president, Mrs. Eleanor G. Regan; secretary, Mrs. J. Koch; treasurer, Miss Elizabeth Rhodes.

The regular meetings of the league are held on the first and third Tuesday evenings of every month at the above address. Practice for those who wish it is at 8 p. m., business meeting at 8:30 and the speaker of the evening at 9.

At the next meeting, on May 16, A. H. Albert, an official of the American Radio League and member of the second district executive council, will speak on "Cooperation and Organization."

All women interested in radio are invited to attend these meetings, and if desired courses in radio telegraphy or telephony can be arranged for.

State Police to Get Radio

The superintendents of state police of the states of New York, Massachusetts, Connecticut, Pennsylvania, New Jersey and Michigan, in conference in New York, seriously discussed the advisability of equipping their stations with radio systems. A system has already been installed in Pennsylvania which will be officially tested this week.

Book Reviews

Two very good books have been sent in this week by the Technical Book Company, New York. Both books are written by an author whose technical works have had national indorsement, James R. Cameron. The first book is "Radio for Beginners." This volume treats in an understandable manner the subject of radio, from the theories of elementary electricity to the adjustment and operation of the different types of modern receiving sets. A number of outfits being supplied by the larger radio concerns are described in detail, and instructions for getting best results out of these sets are also given. The other book is the "Radio Dictionary," a little book containing a wealth of material. All the terms usually met with in radio, electricity, and allied subjects are simply defined. Both books would make a valuable addition to any beginner's library.

The James A. McCann Company, 188 West Fourth street, New York, offers a very good book at a very reasonable price. It is "Amateur Radio," by Maurice J. Grainger, radio expert, formerly with the Westinghouse Electric Company and the United States navy. It opens up with the fundamentals of electricity and leads on to practical operation and theory of the most advanced amplifier sets. Each piece of apparatus is explained in an understandable manner. Near the end of the book is given a glossary of the most important radio terms, and also valuable information concerning time signals and radio laws and regulations.

A little book of merit, "Radio Made Plain," by John D. Haskell, is published by the Radiox Associates, 222 Charles River road, Cambridge, Mass. This little book presents in question and answer form a most useful and interesting mass of data needed by the newcomer in the radio game. Equipment, installation, and use and radio terms are treated in regular order. A quarter buys it.

Proper Tuning Big Factor in Radio Receiver

Tuning of the receiving to the beginner is a thing that has a lot of mystery connected with it. The question has been asked, "How do you know where to pick up the desired signal?" There is no way to tell on a set that the amateur is not familiar with. But, after the set has been in operation for a little while, the beginner will soon learn exactly where to pick up the desired signals. Most sets have dials on them that are divided off into 180 degrees with the numbers engraved on them for every ten degrees. These numbers have nothing whatsoever to do with the wavelength of the station, but are simply put there to enable the operator to remember easily at what point a station will be heard. Usually the lower numbers represent the short wavelengths and as the dial is turned about the longer waves will be heard.

With most sets it is a very simple matter to soon learn exactly where the desired signal may be heard, and the set may be left in the same setting all the time if it is used just for receiving the broadcasting. In other words, the set is tuned to receive the music from W J Z, and there is no necessity to move the knobs again unless other stations are wanted.

The theory of tuning is a long and complicated study, and a few words on the subject may clear up a lot of misinformation. In the first place, every transmitting station has a certain wavelength upon which the transmitted signals or voice is transmitted. The receiving set, however, is capable of receiving several wavelengths by turning the knobs about. A transmitter can also be made to transmit on several wavelengths, but cannot be tuned as fast as a receiver. When your receiving set is tuned to receive a certain transmitting set it is in resonance with the other station. A simple way to explain this is to say that the wave lengths are very nearly the same. This is accomplished by adding or subtracting a certain number of turns of wire in the coils and thus equalize the wavelengths of the two stations. By the addition of different pieces of apparatus it is possible to make this tuning very sharp, and there are some sets that will receive the desired signals only. However, these sets are very expensive and the operator has to be an expert. The average amateur set will not tune sharp and a great deal of trouble has been caused by some beginners filing complaints about some amateur spark transmitter. Usually the spark transmitter is tuned to a sharp wave and is operating legally, while the beginner's set is the one that is at fault, as it is incapable of sharp tuning. If more beginners would study up on these facts before purchasing a set there would not be so much interference. Many amateurs have home-made receiving sets with which it is possible to sit and listen to W J Z all the evening without hearing a single interfering station.

Of course, there are certain cases where it is impossible to tune out the unwanted station with any set. Some amateurs are unfortunate enough to be located very near one of the naval or ship stations, and it is impossible to do any tuning, owing to the close proximity of the transmitter. When buying a set ask for a demonstration showing the selectivity of the set, as by doing this the beginner will save himself a great deal of trouble in the future.

Lift and Drag Effects of Wing-Tip Rake

This report (No. 140) by A. F. Zahm, R. M. Bear, and G. C. Hill of the National Advisory Committee for Aeronautics deals with a description and report of tests carried out at the Washington Navy Yard on models of the RAF-6, Albatross, the Sloane aerofoils to determine the effectiveness of the conventional wing-tip rake in improving aerofoil characteristics. Two degrees of rake were tested on each model; the trailing edge being always longer than the leading edge. The results are compared with the values computed by standard formulae in use at the time the tests were conducted.

A copy of Report No. 140 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Personal

Major B. M. Atkinson, A. S., returned from the Letterman General Hospital on May 4th, and again assumed command of Mather Field.

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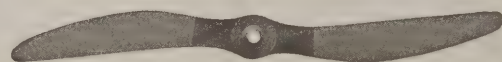
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AERIAL AGE

WEEKLY

Vol. 15, No. 12

MAY 29, 1922

10 CENTS A COPY

Raymond D. Morris
Including Radio Section



The Fokker aeroplane which transported a load of fresh asparagus from New Jersey to Boston, leaving early in the morning and having its contents on the dinner tables in Boston the same day. © J. G. Sholl

**The Domination of Air Power—
Can Airship Builders Walk
Before They Creep?**



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16 NEW AIRPLANES *Complete in original crates* and **3,365 Curtiss Ox-5 Engines**

Are offered by the War Department for your purchase in two sealed bid sales, bids to be opened

IN WASHINGTON, D. C.

JUNE 15 and 29, 1922

At 3 P. M. (Eastern Time)

The offerings are stored, and inspection is invited as follows:

At Buffalo, N. Y., Curtiss Elmwood Air Reserve Depot—

22 airplanes, Curtiss JN4-D, without engines or instruments; no crated. Bids opened June 15.

At Millington, Tenn., Park Field—

16 airplanes—Curtiss JN4-D, complete, in original crates.

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215 " " " " used.

Bids opened June 15th.

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2542 engines, Curtiss JN4-D, new.

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Bids opened June 29.

Bids will be accepted on all or any part of the equipment offered and no special form of bid is required. The Government reserves the right to reject any or all bids. For complete information regarding these offerings, and in transmitting bids, address:

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Approximately 1,212,291 lbs. of Castor Oil, stored at Curtiss Elmwood Depot, Buffalo, N. Y., will be sold by sealed bids to be opened in Washington, D. C., June 16th, 3 P. M. This oil is packed in steel drums of 55 gal. capacity, and in 5-gal. cans.



WAR DEPARTMENT

May 29, 1922



Vol. XV, No. 12

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Printed in U. S. A.

Dealers wanted



DELIVERING a 3-place Lincoln Standard Tourabout to Messrs. Bell and Long of Kansas City, Mo., December 21st, 1921, at zero temperature. (Note the aluminum covering on lower half of the radiator.) On account of the extreme weather conditions their flying instruction was transferred to the Oklahoma City flying field.

Nebraska Aircraft Corporation
Lincoln, Nebraska

Here's the List!

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THE NATIONAL
TECHNICAL, ENGINEERING AND TRADE
AUTHORITY

With which *Flying* is consolidated

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V. XV

NEW YORK, MAY 29, 1922

No. 12

Can Airship Builders Walk Before They Creep?

FOR many months the Navy Department has been engaged in the design and construction of a giant airship known as the ZR-1. This ship is understood to resemble in many ways the ZR-2, which, it will be recalled, crashed during test flights in England, with the loss of many lives, less than a year ago. It has recently been announced that Rear Admiral Wm. A. Moffett, Chief of the Naval Bureau of Aeronautics, has requested the National Advisory Committee for Aeronautics to appoint a special committee of engineers to make a complete and detailed study of the plans and specifications for the ZR-1, with a view, it is understood, to securing a check on the stresses involved. While the Navy is said to be confident that its own plans for the airship are correct, it desires the opinion of an independent committee in order to avoid the possibility of future adverse criticism. This is a wise and long-sighted procedure on the part of Admiral Moffett, especially in view of the recent catastrophes with lighter-than-air craft and the fact that many misgivings as to the likelihood of a similar occurrence when the ZR-1 takes the air are being expressed by many well-wishers for the future of aeronautics.

In the absence of specific information regarding the design and type of construction to be employed in the new ship, it is soon to draw conclusions as to the correctness, from an engineering standpoint, of plans already completed and being followed in manufacture of parts. It may not be amiss, however, to ask some rather pointed questions which might well make the subject of another investigation as to the wisdom of continuing with the construction of so large a ship at such great expense as is involved, even though the investigation now requested shows that the design is based upon proper stress calculations and appears to be "safe" so far as present engineering knowledge of the subject goes.

The British, at one time enthusiastic over the possibilities of the rigid type of lighter-than-air craft, are reported to have completely abandoned their civil and military program of development along this line and to have offered for sale all ships of this type. What reason is there for doubting that a similar course would not be expedient upon the part of our own Government?

The Germans, who have admittedly obtained the greatest degree of success in the construction and operation of airships of the rigid type, are reported to have declared that construction of the largest Zeppelins was justified only as a war measure—that the experience in the construction of smaller ships did not warrant going to such large designs and that such designs would not have been thought of in time of peace. Yet the ZR-1 is understood to be as large or larger than any airship ever built. Is there sufficient justification for such a prodigious undertaking?

The successful operation of lighter-than-air craft is generally considered to depend upon careful training and experience, which

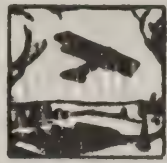
is usually gained first in handling small ships. How is such experience and training to be gained by Navy personnel when the Navy possesses no small, lighter-than-air ships of the rigid type? Would it not be more practicable to start with a much smaller ship, or even a number of them, modeled, if need be, after some of the highly successful Zeppelins, and thus build up an experienced personnel which could expect to handle a larger ship with minimum chance of disaster?

In short, does it not involve unnecessary risk to attempt building an "Old Ironsides" before a successful smaller ship of similar type has been constructed and flown?

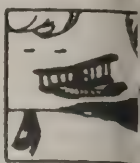
In asking these questions, AUTOMOTIVE INDUSTRIES has at heart nothing but the best wishes of the Navy and for aeronautics, which we confidently hope will develop sanely and as rapidly as a healthy growth will permit. Another disaster such as that which occurred to the ZR-2 in England and the Roma at Hampton Roads may do irreparable damage. Huge sums have already been spent upon the ZR-1, but these may well be sacrificed rather than face the result of a possible disaster which might for many years completely check progress in one important field of aeronautics.—AUTOMOTIVE INDUSTRIES.

The French Gliding Competition

ENCOURAGED by the successes attained in the German soaring and gliding tests in the Rhön mountains last year, the French Aerial Association and the Aero Club of Auvergne are organizing a somewhat similar competition at Puy de Combrasse, near Clermont-Ferrand, Auvergne, between August 6 and August 20. A total amount of prizes of 100,000 francs is to be awarded. At the present rate of exchange this amounts to approximately \$10,000. As the machines need cost very little—certainly it should be possible to build a glider for \$250 to \$450—the prizes should be ample for more than covering expenses, and we trust to see this country represented at Clermont-Ferrand. At present there are several amateurs interested in gliding, but no actual flights have, so far as we are aware, been yet made. The French competition should afford a good opportunity for constructing a glider with at least a sporting chance of covering its cost by winning a few prizes. For this reason we welcome the French competition, and it may well prove the beginning of an active interest in this form of flying being taken in this country also. Next year the Aero Club of America might do worse than organize a similar competition at home. There will then be both the French and German experience to draw upon for data. We are not among those who think that experiments of this sort will lead to motorless commercial flying, but quite a lot may be learned, at comparatively low cost, about aerodynamic efficiency, which could be incorporated in commercial machines with considerable gain in economy.



THE NEWS OF THE WEEK



Navy Asks 213 Planes Aboard Fleet This Year

WASHINGTON—Plans for complete equipment of the fighting fleet with aircraft during the coming fiscal year, it was learned May 12, have been laid before the Senate Naval Committee by Rear Admiral Moffat, chief of the Navy's Bureau of Aeronautics. The project contemplates placing 213 aeroplanes, of various essential types on battleships, cruisers, scouts and other vessels and is designed to supply the fleet with its own aerial defense against aircraft attacks.

Under the plan eighty-six small, swift fighting planes will be included in the aircraft to become a permanent part of the fleet aircraft defense.

In addition, the active ships will carry forty-six observation and spotting planes, twenty-seven small spotters, thirty-six torpedo or bombing planes, eighteen scouts and four kite balloons for observation purposes. Each battleship of the eighteen comprising the fleet under the naval limitation treaty will carry four planes, two V-F, or single fighters, one big spotter and one torpedo or bombing plane. The torpedo plane will permit attack on enemy surface craft with 1,500-pound torpedoes or with an equal weight in bombs.

Zeppelin Company Fights U. S. Deal

An action alleging libel has been instituted by Prof. Johann Schuette of the Schuette-Lanz Airship Company against the Zeppelin Company.

The Zeppelin concern is said openly to have insinuated that Prof. Schuette's agreement with the General Air Service of America probably would reveal the unconditional surrender to foreign interests of notable German inventions, and further to have claimed priority rights to patents not now controlled by Schuette.

The Zeppelin concern intimates that it shortly will proceed legally to establish its right to the patents in question. It hints that the American corporation probably will be called on to contest the suit, as the patents on which it claims to own control probably are the same as those registered by Schuette in Germany, which largely "constitute the intellectual property of Count Zeppelin."

The forthcoming suit is expected to involve litigation by both the German airship concerns over patents which for a long time have been the source of hostility between them. The Zeppelin concern recently concluded an alliance with Spanish and American financial interests with the purpose of founding a transoceanic air service.

During the recent visit to the United States of Dr. Schuette it was said that he had signed contracts giving the General Air Service Company the manufacturers' rights and patent interests of the Schuette-Lanz airships for the entire world. Dr. Schuette was quoted as having said these rights would give the United States the premier position in world aeronautics.

A dispatch from Berlin shortly afterward quoted the *Vossische Zeitung* as asserting that Prof. Schuette would have to give some explanation "that would satisfy the German people" for permitting his patents to be used without the participation of German capital.

Northwest Aeronautical Society

On April 19th, a body of Seattle men interested in aerial activities met and organized the Northwest Aeronautical Society for the purpose of furthering aeronautics in all its phases. The Society intends to maintain a concentrated technical library and to disseminate information both technical and literary to enthusiasts and the general public.

It intends to hold classes, readings and lectures for the benefit of both beginners and advanced students of aeronautics. To relieve the monotony of study and serve as a practical demonstration of theories and designs advanced by members it is planned to hold a gliding and soaring meet during the latter part of the coming summer.

Worthwhile legislation favorable to aeronautics will be actively supported by the organization and assistance will be rendered the government in establishing an aerial defense for America.

Officers elected were: Orrin E. Ross, President; Walter Clayton, Vice President; J. W. Miller, Chief of Technical Staff; Arthur Sherman, Secretary-Treasurer.

First Aero Lighthouse

An aero lighthouse, the first permanent night guide for flyers to be operated in America, was put into service, May 14, at College Point, at the entrance to Flushing Bay at the plant of the American Airways Company. The light is a steady beam thrown skyward from a high-power searchlight. As stated in a notice to navigators sent out by the navy hydrographic office, the light will be shown from sunset to midnight.

This beacon, which was authorized by the superintendent of the Bureau of Lighthouses at Tompkinsville, Staten Island, is the first of a series to be erected along the air route from New York to Chicago. They will be placed a few miles apart and will mark out an illuminated path that will enable aviators to make night flights in safety. In other sections of the country, it is stated, similar courses will be marked, so that night flying may be made safe along all recognized routes.

The College Point light will be inclined toward the north. On the approach of a plane the light house guard will swing the beam into the wind and the aviator can land without getting the light in his eyes. When the plane comes to rest on the waters of the Sound any interfering craft in front of it will be plainly indicated. The aviator will follow the light until it comes to rest upon the buoy to which he is to tie up.

Building Two Zeppelins

Keeping within the limits laid down by the Treaty of Versailles, the Zeppelin works have begun the construction of a new experimental type of dirigible of 30,000 cubic metres capacity. This dirigible will be used chiefly in connection with the new plan for wireless orientation for night landings during transcontinental flights. Finally the ship will go into the hands of a Spanish concern as a schoolship for the Seville-Buenos Ayres Line.

The construction of a dirigible of 100,000 cubic metres to replace the Zeppelin originally assigned to the United States, which was destroyed in 1919, was started at the same time.

Asparagus by Air, Jersey to Boston

A thousand pounds of asparagus was eaten on Boston dinner tables growing in beds along Raccoon Creek Swedesboro, N. J., the same morning. They traveled the air route, by way of demonstration that the transportation of fresh vegetables thus is practicable. The 450-mile trip was made in about five hours. The plane that carried them is scheduled to fly back to New York laden with chocolates from a Boston candy factory for New York stores.

The machine chosen for the demonstration was a Fokker monoplane. It took off from Mullica Hill in Gloucester County, N. J., at 10:05 in the morning, piloted by William N. De Wald, a former service flier, who carried one passenger in addition to the vegetable load. De Wald flew to Mineola, L. I., landing there at noon on a gasoline supply.

The plane reached the Framingham flying field, twenty-four miles from Boston at 3:15 in the afternoon. De Wald circled for forty-five minutes trying to locate the airdrome. Then two pilots who realized his difficulty went up and guided him to the landing place. From Framingham asparagus was rushed to Boston. A package was sent to Mayor Curley of Boston and another to Governor Cox of Massachusetts, as gifts from the Gloucester County Board of Agriculture, who arranged the trip.

When the Fokker came down it was met by the representatives of the Massachusetts and New Jersey Departments of Agriculture. One package of chocolates to be brought on the return flight will be sent to Mayor Hylan of New York.

Chicago Pageant of Progress

The Second Annual International Pageant of Progress will be held in Chicago July 29, to August 14. It will comprise three and a half miles of exhibit booths and it is the plan of the committee in charge to devote considerable attention to the aircraft division. More than a million people attended last year and it is expected that this number will be doubled this year. It will therefore readily be realized that the Pageant offers an excellent opportunity for aircraft concerns to cover the middle western territory by being represented. Communications should be addressed to C. S. Rieman, Chairman, Aircraft Division, 7 West Madison Street, Chicago, Ill.

Blanchet Wins French Annual Balloon Race

Georges Blanchet of France is unofficially declared winner of the annual balloon race for the Grand Prix of the Aéro-Club of France, having landed near Bordeaux, 245 miles from the Tuileries Gardens in this city, where the race was started. M. Blanchet won the Grand Prix in 1908, 1909 and 1910.

Lieut. E. de Luyter of Belgium, winner of the Gordon Bennett balloon race in the United States in 1920, finished fifth among the eleven starters, with a distance of 110 miles. It appears that he lost the premier honors when his daring plan to cross the Bay of Biscay to Spain was frustrated by a shift in the winds.

The AIRCRAFT TRADE REVIEW

Sales Opportunity

The Aeronautical Chamber of Commerce is received a request from the Foreign Trade Department, Banca Commerciale Italiana, Agency in New York, 62-64 William street, for catalogues, price lists, statistics, photographs, etc., of American-made aircraft, engines, airships, accessories, materials and supplies for display in their various branches throughout Peru. It is requested that this material be sent to the New York address given.

Allies' Ban on Big Planes Brings German Reprisal

Forbidden by the Allies to construct large airplanes for commercial purposes, the German Government has countered by closing German territory to all aerial transport of large planes. In diplomatic wording this means that the Germans answered the Allies: "We cannot fly and neither can you, because our restrictions will prevent the French and British extending several of their international passenger services, notably those to Prague and Constantinople."

The Germans claim that the Allies' restrictions as to size would kill commercial flying. They hope, therefore, to force a modification of the terms, so that commercial aviation in Germany may not be suppressed altogether.

Major George Neumann, a German air expert, said the Germans would keep their airplane technicians, but he feared there were obstacles to building large numbers of commercial planes for one or two years. He said the present restrictions would prevent planes carrying fuel for more than the hours' flight. The only airship the Germans are building is a 45,000 cubic meter Zeppelin, intended to serve in aeronautic study, and to maintain a mail service between Berlin and Stockholm. Germany would gladly build a Zeppelin for America, Major Neumann said, but he regarded the fact that the Americans reduced the specification to 170,000 cubic meters as a victory for the French, who had sought to block construction of airships by Germany. The construction of this craft for the United States has been begun, but is temporarily delayed on account of the metal workers' strike.

The allied control commission also forbade delivery by the Schuette-Lanz company of a rigid dirigible to America. But the firm is evading control in manufacturing parts for eventual assembly in America. Three dirigibles are under construction in this manner for an American firm which intends to operate them between New York and Chicago.

The German Air League congress recently was held in Muenster, 120 clubs, with a total of 10,000 members, being represented.

Success of the Aeronautical Executives' Luncheon

The luncheon held on Friday, May 12, at the Café Boulevard, at which there was in attendance a splendid representation of all

the aeronautical companies in the vicinity of New York, completed with success the eighth semi-monthly gathering of the Aeronautic Executives.

Prior to the introduction of the speaker, Chairman R. R. Blythe, who organized these informal gatherings, said: "During the period of four months we have had at these luncheons representative executives of all the reputable aircraft companies in the vicinity of New York. It is to be sincerely hoped that these meetings will become a permanent figure in the building of future industry—that they will constitute the means of informally bringing together those executives upon whom rests the responsibility of 'putting over' commercial aviation.

"Gentlemen, it has been an honor," continued Mr. Blythe, "to have been allowed to preside as chairman and to have been given the opportunity and pleasure to be able to bring together twice a month those whose names in the future will be written in aeronautical history as the founders of the greatest transportation industry of the country.

"Owing to the oncoming Summer, with its new aeronautical activities, many of those present will have to be often away from New York. It has, therefore, been decided in the consensus of opinion that these meetings will be held once a month; the succeeding meeting, therefore, being on the second Friday in June."

The speaker, J. E. Whitbeck, superintendent of the Eastern Division of the United States Air Mail, was then presented to those present by Mr. R. R. Blythe.

"The only air mail route in operation now is the transcontinental route between New York and San Francisco," said J. E. Whitbeck. "At the present time we are not doing any night flying; however, we all feel that the time is not far distant when we will do night flying. The time then between New York and San Francisco will be reduced to less than thirty-six hours.

"It is quite remarkable to note that on all the trips started between New York and Chicago for a period of six months there only developed one-half of 1 per cent of mechanical troubles that caused forced landings. Also 93 per cent of all scheduled trips over the whole service between New York and San Francisco were completed during the past year. About 6 per cent were lost on account of extremely bad weather, which leaves only 1 per cent that could be laid directly to mechanical troubles or other causes.

"It is also interesting to state," continued J. E. Whitbeck, "that 5 of the 6 per cent of the trips which were forfeited on account of extremely bad weather could be directly attributed to fog, and only 1 per cent to rain and snow, hail, wind, etc.

"We have made several hundred minor changes in the ships which we are using, and have been able to develop a plane that is giving an average of more than 400 hours between overhauls. Plane No. 189, which is in service between New York and Bellefonte, has been flown over 400 hours by Pilot Lewis and has not yet had a mechanical forced landing.

"I might mention that we recently completed 1,600 hours of flying without any serious motor troubles, and as our average speed is nearly 100 miles per hour the distance traveled would equal that of nearly six times around the world.

"Taking an average load to consist of 16,000 letters at two cents each, we have during the operations of the month of March shown that there could have been made a profit of over \$8,000. All expenses were figured as occurred with exception of insurance and sales and advertising expenses.

"It is most reasonable to believe, then," said Mr. Whitbeck in closing, "that a commercial aircraft company can operate on the air mail routes and make it a paying venture."

Travelers' Blue Book

The Travelers' Blue Book, published by the American Travel and Hotel Directory Company, of Baltimore, Maryland, should be on the desks of every aircraft service company for the reference of its clients. It is one of the most comprehensive works of its kind and covering each state, province or republic there is an introductory review of its history, products, points of interest, holidays, climatic reports, and hunting and fishing information.

The cities are covered as to altitude, population, location, transportation facilities and the hotels, their rates and capacities.

In the Directory there is also a list of clubs and their activities which are of particular interest to aeronautic development companies.

Aero Club of Illinois

Major Cedric Faunt Le Roy, Commander-in-Chief of the Polish Air Forces, addressed the Aero Club of Illinois, on May 12 on the "Uses of Aviation in Open Warfare." His address was greatly enjoyed by the Chicago aeronautic enthusiasts.

Point Drag and Total Drag of Navy Struts No. 1 Modified

This report (No. 137) by A. F. Zahm, R. H. Smith and G. C. Hill, of the National Advisory Committee for Aeronautics, deals with the results of tests on struts conducted at the Washington Navy Yard. Two models of the modified Navy strut, No. 1, were tested in the 8 by 8 foot wind tunnel. The tests were made to determine the total resistance, end effect, and the pressure distribution at various wind tunnel speeds with the length of the strut transverse to the current. Only the measurements made at zero pitch and yaw are given in this report.

A copy of Report No. 137 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

N. A. C. A. CONTROL POSITION RECORDER

By F. H. NORTON

Summary

A NEW instrument is described which is capable of simultaneously recording the position of the three controls of an aeroplane. The records are taken photographically on a standard N. A. C. A. film drum and the instrument can be quickly installed in any aeroplane. The instrument is of value not only for scientific research on stability and controllability, but also as a means of checking up the flying of pilots.

The instrument as shown in Fig. 1 consists essentially of the base plate and film drum mounting used on all the N. A. C. A. recording instruments. The constant speed driving motor (1) rotates the film clutch (2) at a speed of about 1 r. p. m. through worm gearing in the base. The motion of the controls is transmitted to the instrument through the cords (3) which are wrapped around three drums (4). The drums are mounted on a horizontal screw and contain a spiral spring which keeps the cords wound tightly. Thus a 12-inch motion on the end of the cord is converted into a 3/16 inch lateral motion of the drum. This motion is transmitted by a system of levers (5) to the three mirrors (6) which reflect the light beam onto the film through the lens (7) in the same way as with the other N. A. C. A. recording instruments. As three separate records are superimposed on one film it is necessary to have some way of distinguishing between them. This is accomplished by revolving slowly in front of two of the mirrors a sector shutter (8). One mirror therefore gives a continuous line, one a dotted line, and one a dash line.

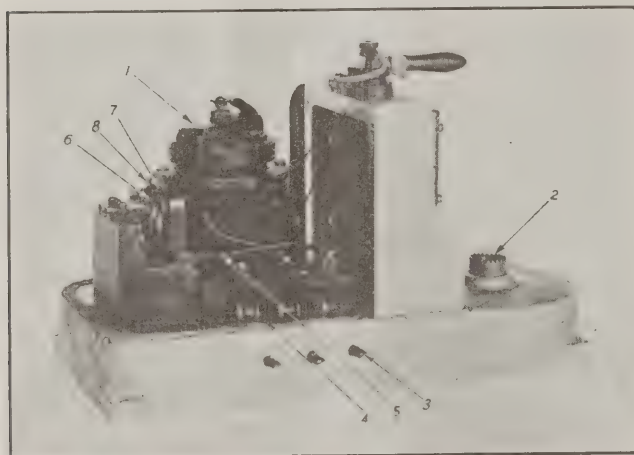


Fig. 1. Control position recorder



Fig. 2. Records from the instrument

The cords can be connected directly to any convenient portion of the control system, but if it is desired to have a high degree of accuracy it is advisable to run small steel wires to the control horns so that any backlash in the control system may be eliminated. If this is done a precision of $\frac{1}{4}^\circ$ can be easily obtained, and this is quite sufficient for any ordinary work. The instrument is calibrated in place by setting the control surfaces to given angles and taking a short record on the film for each setting.

Some records taken by this instrument on a JN4h are shown in Fig. 2. Although they are not as clear as the original film the different records can be distinguished. The curves are usually replotted by measuring the distances on the film from the zero lines and then multiplying by the calibration constant to give the true angle in degrees. These angles are then plotted against a time base so as to agree with the records from other instruments. The record of the landing shows the three-second vertical timing lines placed on the film by light in the instrument case which is connected, together with timing lights in other instruments, to an electric chronometer.

This instrument has been used mainly by the National Advisory Committee for Aeronautics in the study of stability, controllability and maneuverability. For this work a knowledge of the position of the controls is essential but the method formerly used of reading the angle visually was too slow and inaccurate for most of the work. This instrument will obtain more data in a few minutes' flights than could be obtained before in flights of many hours, so that the cost of this kind of research has been greatly reduced by this means. Another use of this instrument is for the study of control movements in various types of maneuvers. This is quite important as the pilot cannot remember exactly how he moves his controls in order to execute a given stunt. It would also be of considerable value to check up on new pilots and to show them how their execution of a maneuver differs from that of a skilled pilot.

EVOLUTION OF MODERN AVIATION AND EXPERIMENTAL AND TECHNICAL RESEARCHES IN AERODYNAMIC LABORATORIES

By A. TOUSSAINT

Director of the Aerotechnic Institute of Saint Cyr *

THE art of constructing aeroplanes is now in full evolution, not to say revolution. This transformation is still proceeding slowly, but for many builders who have not hesitated to leave the beaten track, this slowness has been due to difficulties of a financial or material rather than of a technical order.

This evolution affects very different points, such as the general shape and dimensions of aeroplanes, the materials used in their construction, etc. These considerations are, moreover, mutually related. We know, in fact, that the exclusive use of metal depends on the size of the aeroplane and the shape of its wings.

We propose to examine here only one of the essential causes of this evolution, that arising from experimental researches and theoretical studies in aerodynamical laboratories.

WINGS

General Characteristics of Good Wing Sections

Modern aeroplane wings have sections and shapes clearly deduced from the most recent discoveries of aerodynamics.

* Taken from "L'Aerophile," November 1-15, 1921.

Let us first consider wing sections. A good wing section must offer the minimum parasite resistance and be capable of producing considerable lifting forces.

The drag of a wing section generally comprises two parts:

1. The resistance due to the friction of the air on its wet surface;

2. The resistance due to impact and to the separation of the air from wing, with the consequent parasitic vortices.

The drag of good modern wing sections is reduced almost entirely to the first kind of resistance, that is, to friction. This constitutes a considerable degree of progress, which the laboratories have been able to put into effect, as a result of improvements in their equipment. Hence the contour of these wing sections is such that the molecules of air encountered by the wing follow its surface without impact or separation. The air "acts" perfectly on these wing sections, like fluids on the blades of a turbine. Of course this maximum improvement covers the range of the angles of attack employed in aviation, which, however, already constitutes quite an extensive domain. The impact and separation of the air streams are always experienced, even on very good wing sections, whenever the angle of attack is very much above or below its normal range.

It is well to note that a long series of these good wing sections has been designed in accordance with the theory of the motion of perfect fluids. This had previously been determined for the best shapes of airships and streamlined rounded bodies.

Drag Due to the Friction of the Air

The friction of the air on the wings is not a negligible quantity. Many experimenters have determined its laws of variation with the speed and surface areas. We thus find that the friction does not increase exactly as the square of the velocity nor as the area of the surface. This means that the friction on one square meter of surface will be just so much less, for a given speed, as the square meter under consideration forms part of a larger surface. In the same way, equal speed accelerations do not correspond to equal increments of friction. The laws of friction, of the air on plane surfaces, are well known and can be applied with just so much closer approximation, as there is less separation of the fluid molecules from the modern contours. We accordingly find that one square meter of lifting surface on an aeroplane flying 100 m/sec (360 km/hr) will require about 8 HP to overcome friction alone, assuming the surface to be *well polished*. This figure might be modified with a less perfect polish. For the aeroplane built only for speed, like those participating in the Deutsch contest, the lifting surface being 12.5 square meters, for example, the engine power absorbed by the friction on the wing alone would be about 100 HP. To this must be added the power absorbed by the friction of the air on the other parts of the aeroplane. Accurate knowledge of the resistance due to the friction of the air, therefore, requires that the constructor varnish and polish, with the greatest care, all the exterior surfaces of his aeroplanes. We know, moreover, that another object of this varnishing and "doping" is to shrink the fabric covering of the wings. With progress in construction, fabric need not be con- sidered, but the wood or metal coverings replacing them must be carefully polished if there is to be an improvement over the small coefficients of friction of the varnished fabric surfaces now employed.

Of course, the amount of the power absorbed by friction is not so great in an aeroplane of medium speed (commercial), though the increased friction due to its larger dimensions partly offsets the diminution of friction due to lower speed.

Drag Due to Lift

Unfortunately, the drag of a wing due to friction is not the only drag. There is also the drag due to the lift, required to support the weight of the aeroplane. This has been found to be proportional to the square of the lift. The cost of the lift consequently increases very rapidly with the magnitude of the drag.

But the coefficient of proportionality, that is to say, the other factor which enters into the value of the drag due to the lift depends only on the shape and disposition of the aeroplane. It seems therefore that the coefficient could be made very small, by the means of construction at our disposal enable the realization of the best shapes and dispositions. Experience has, in fact, shown that increasing the aspect ratio and the gap is the proper means of diminishing the drag due to lift.

As a result of the experimental researches and theoretical studies in aerodynamic laboratories, the constructing engineer can now determine in advance the advantages or disadvantages inherent in all the shapes and dispositions suggested to him by the requirements of construction. He can definitely determine whether he must employ a single wing (monoplane) or a biplane or multiplane cell and the best proportions to give them.

Fuselage, Tail Planes and Other Aeroplane Parts

The laws of the resistance of the air to the fuselage are likewise accurately determined experimentally. In truth, a fuselage should have the shape of a revolving solid with the least head resistance. We can determine in advance the correct outline followed by the fluid molecules in air without viscosity. For such an outline, especially applicable to airship hulls, the head resistance is almost entirely due to the friction of the air. The amount due to impact and separation of the fluid streams is very small on such hulls and frequently does not exceed one-tenth of the total drag.

As for aeroplane, fuselages, the necessities of construction, conditions of inhabitability and equipment, and communication with other parts often necessitate modifications of the ideal outline. Nevertheless, the practical fuselage forms are tested in aerodynamic laboratories, which determine all their characteristics and also the influence of the particular dispositions due to the equipment or to the communications with the other parts.

In the same way, the aerodynamic properties of the tail planes, taken singly or in conjunction with other parts, have been studied experimentally in great detail.

The case is the same with resistances due to landing gears,

external fittings, etc. For these parts in particular, the laboratory has shown that the values of the resistances measured on small models are rarely applicable to the full size. Fortunately, the experimental apparatus has been sufficiently improved to enable the direct testing of these parts in full size. It is the results of these measurements that the engineer must apply in his calculations.

Interaction of Aeroplane Parts

By interaction is meant the reciprocal action of two or more parts of an aeroplane or other aircraft, a reciprocal action which modifies, to a greater or less degree, the aerodynamic properties of each part taken separately.

Certain of these interactions have been accurately determined and can be calculated in advance for various combinations of two parts. These include, for example, the interaction or gap resistance of two or more wings superposed in such manner as to form a biplane or multiplane cell.

The interactions of the wings and horizontal tail planes have likewise been determined by a very complete study of the magnitude and direction of the downwash behind a wing.

Other interactions are of a more complex nature and can only be determined experimentally in each particular case. Such are, for example, the reciprocal actions of the wings and fuselages, exterior fittings, the ground, etc. Lastly, as we shall see further along, the propeller itself reacts on the various parts of the aeroplane.

The total drag of an aeroplane can therefore be calculated from the individual resistances and interactions.

Aeroplane Propeller

Propellers have been the object of a considerable number of systematic experimental researches. It may be said that the constructing engineer can surely find in this accumulation of documents the most suitable propeller for solving his particular problem. Moreover, general rules have been established which still further extend the field of application of the experimental results.

Lastly, the interactions of two tandem propellers and those between one or two propellers and the wings and fuselages of an aeroplane have been determined experimentally. Rules have been enunciated which render it possible to establish with certainty the complex engine-propeller groups of certain types of giant aeroplanes. Numerous and varied data enable us to calculate the interaction of propeller and aeroplane.

Aeroplane in its Entirety, Evolution of Shapes

Either by the sum of the individual resistances and interactions of its parts or by testing a small model, the aerodynamic properties of a complete aeroplane have been determined in aerodynamic laboratories.

The engineer accordingly has in hand all the data for calculating his aeroplane and for determining its performances, degree of stability, maneuverability, etc. He knows the aerodynamic price, that is to say, the share of the total drag borne by each part, and consequently the engine power required for predetermined performances.

Under these conditions, he can work out the structural details with more confidence. It must be noted that the study of peace-time aeroplanes and especially of large modern aeroplanes necessitates large expenditures. The construction, followed by final adjustments and trials, requires considerable capital. It is therefore important to leave nothing to chance and to prevent failure at any cost.

Knowledge of the aerodynamic characteristics of aeroplanes has drawn the attention of investigators to the great importance of parasite resistances and interactions between essential parts, namely, the wings and tail planes. One of the most marked improvements in modern aeroplanes consists in obtaining aeroplane forms for which these parasite resistances are zero or as nearly so as possible. By utilizing modern wing sections, which, aside from their aerodynamic qualities, have the advantage of being relatively thick, engineers have been enabled to place nearly all bracing, engines, etc., inside the wing, so that the aeroplane tends toward a flying wing, equipped with one or more fuselages for supporting the tail planes and landing gear.

One of the essential factors in modern progress and evolution of aviation evolves therefore from the experimental researches and theoretical investigations of aerodynamic laboratories.

Conclusion

The technical data already obtained by the experimenters of the different countries is considerable, but the problems are continually changing and increasing.

It is therefore important for our aerodynamic laboratories to be provided with the necessary material and means for performing the immense task devolving upon them. It was,

in fact, by increasing the efficiency of the experimental apparatus that the remarkable properties of modern wing sections were discovered. Perhaps by tomorrow these means will be insufficient.

It is important, especially for the present, to utilize to the fullest extent the experimental equipment of existing laboratories. This is simply a question of sufficient appropriations for paying the indispensable technical experimenters. An experimental investigation is not simply making more or less accurate weighings or measurements, but it necessitates a thorough study of the problem presented, of previous documents and of the causes of error, a judicial and critical analysis of the data obtained and the making of deductions therefrom. This work is of an order more intellectual than material and constitutes the reason why it should only be entrusted to competent intellects. Such a select personnel merits material recompense corresponding to the nature of its work.

In this connection, theoretical investigations are desirable and should even precede the experiments. It is remarkable that most of the good modern wing sections were designed by purely theoretical methods. The teaching of theoretical aero-

dynamics should be systematized in this respect, not simply because it constitutes a science of general culture (general motion of fluids), but also because such instruction will direct many of our future professors and scholars toward the technical problems of aerial locomotion.

Government appropriations and private donations to this work will constitute an investment of the first order, for science pays dividends in the form of discoveries whose far-reaching moral and financial effects are incalculable. Aeronautics is no exception to this rule.

It would, moreover, be extremely dangerous for our future safety to fall behind certain other countries in this respect, which, unfortunately, is now the case. Nevertheless, we have in France, everything necessary for conducting these researches and, in certain respects, we even possess better experimental apparatus than any other country. Let us beware lest our failure, for the sake of economy, to provide for the appointment of a few additional engineers may cost us very dearly in the future.

Translated by the National Advisory Committee for Aeronautics.

TRANSPORTATION'S ULTIMATE—THE AIR MAIL

By JOHN R. CAUTLEY, in "The Wright Engine Builder"

EACH great advance of transportation has resulted in a corresponding change in our civilization and advancement in social relations. Look back, if you will, and it is easy to find how the gradual evolution from the animal to the sledge helped civilization. The evolution to the wheel vehicle, with the consequent interest in highways, was very slow, but civilization took a distinct advance due to the greater ease of communication and trade.

With the invention of the steam engine and the locomotive, which came very soon after, civilization took a tremendous jump, and the telegraph, telephone and finally the wireless made for additional strides in our social development. The automobile and the motor truck have in the more recent years added to our means of transportation and thereby completed what the telephone began in the bringing of our farmers and other outlying folk into close touch with the rest of the community. All these developments have been made simply because of greater speed (in which is included mail) from in the transmission of articles of commerce to place, and if this speed can be still further increased, without additional cost, civilization will take another great stride forward.

The first railroad train ran less than a century ago and for some time railroads were used only for transporting freight, and for a still longer time, trains were not run at night at all. While it is nearly a century since the railroad was invented, it is less than 20 years since the first practical power-driven aeroplane was flown. Yet, during the past two years, a non-stop flight was made across the Atlantic and a machine was flown from England to Australia without replacement of engine or parts. This is more than half around the world. Heretofore, our means of transportation have been limited, as one might say, practically to two dimensions. Ships are limited to the surface of the sea and trains and automobiles to the surface of the earth, relatively speaking. Railroads and motor transportation is still further limited by the necessity for rails and roads, so that the ship has one great advantage.

The aeroplane not only has the advan-

tage of requiring terminals or harbors only like ships, but in addition to the two horizontal dimensions, it is free to take its own altitude, and this opens up a tremendous possibility in the way of freedom from congested traffic conditions. This is only one of the factors which will help the development of air transportation.

The main factor is that of speed. Not speed for a short period with the necessary slowing down for curves, switches, city conditions, etc., but the sustained speed which is possible only in the transoceanic ship and the aeroplane with its freedom from any fixed path of travel. While trains make as much as 70 or 80 miles an hour at times, their average speed is seldom over 50, even on the crack runs. Aeroplane speed for commercial purposes can now be made easily 100 miles an hour, and the percentage of time when there is an adverse wind of more than 20 miles an hour is very small indeed, so that the average speed of transportation for aeroplane may even now be calculated as at least 50% greater than that of the fastest train. The train is a long way along in its development, and the aeroplane is only at the beginning. Does it seem, therefore, too much to say that the aeroplane has a commercial means of transportation which may be regarded as being at least twice as fast as a train? Time is a vital factor in the value of some things. Therefore, high-speed transportation of certain freight, and mail is classed as freight, is worth a tremendous amount of money to people in this country, because of the saving of losses due to waste of time. Mail, therefore, and express packages such as topical films, newspaper articles, etc., in which time is the prime factor as an element of value, can be transported to the great advantage of the United States by aeroplane.

The question comes up at once, "is this not too expensive?" In the first place, it can be shown to-day that such transportation is not as expensive as has been supposed, and in the second place, it should

be pointed out that transportation at such speeds must be relatively expensive in the development stage, and that it is sure to be reduced as time goes on and we learn more about the air. The only way we learn about the air is by flying in it.

From another angle, it should be remembered that in spite of the fact that transportation by railroad is much more expensive than by canal boat, there are a mighty few canal boats used in this country, and relatively few in any country where the railroad transportation is good. The answer to this is speed. Until freight has been transported freely and for a considerable period over long distances so that there is a real body of information from which to draw conclusions as to safety, reliability and speed of aeroplane transportation, passenger transportation except in exceptional cases, will have to wait.

The people of the United States have always been willing to spend any amount of money to develop a new thing which would be for the good of all the people as soon as it could be set before them plainly that the new thing was going to be of real advantage. It is our belief that air mail is the only method by which we are going to be able in this country to develop a means of transportation which will add enormously to the wealth and contentment of the country at large. The air mail is and must be the practical laboratory for the development of commercial flying. This is for the reason that mail is the particular form of freight in which the time element of value is greatest, and if we can prove the advantage of aeroplane transportation in this form, we will carry along the development of the art.

Since the beginning of the world, the people of the earth were confined to two dimensions until the Wrights flew in 1903. It seems incredible that people of the United States should allow some other Nation to be the first to become the master of the third dimension. The air mail is the stepping stone toward the commercial mastery of that dimension and that is the reason we should back it.

THE DOMINATION OF AIR POWER

By Rear Admiral W. F. FULLAM

U. S. N. (Retired) in the New York Tribune

THE civil war in China sounds a warning to the world. A press report brings the news that one action with a few bombing planes attacked the gunboat fleet of the enemy and forced it to surrender. The air fleet triumphed over the surface fleet. Ships are helpless if they lose the command of the air above themselves.

This incident carries far. The lesson is not confined within the limits of the Chinese empire. It not only affects the military and naval plans of all nations but it will ultimately serve to greatly increase the defensive strength of China and it will profoundly affect the political and aggressive policies of all nations that may assume to dictate to the Chinese empire in years to come.

During the past century, owing to Chinese weaknesses and unpreparedness for war, all nations have protected their missionaries and their "interests" in China as well as their legations in Peking by sending small gunboats up the rivers, by establishing armed legation guards and occasionally re-enforcing their demands with special naval demonstrations along the coast of China. In other words, it has been an easy matter to dictate to the Chinese people and bring them to their knees. Foreign powers could seize Chinese territory with impunity and maintain their naval and military forces on Chinese soil and in Chinese ports despite the protests of Peking.

End of Aggression Foreseen

Let us now picture the change that may logically follow this trifling incident in the sinking of gunboats by aircraft. Suppose a strong, stable government is established in China in the not distant future. In that event we may assume that the Chinese will realize the importance of air power and provide themselves with a strong national air force. If so, they may forbid foreign gunboats penetrating their rivers for thousands of miles. They may forbid the march of foreign troops to Peking without their permission.

They may demand that their soil and their sovereignty shall be respected like those of England, France, the United States and other nations—that foreign troops shall not be sent to Peking for the same reason that they are not sent to Washington, London, Paris or Tokio.

But this is not all. No fleet, however powerful, not even that of Japan, could safely anchor in Chinese ports or approach her coast within one hundred miles if China provides herself with a powerful air force supplemented by mines, small submarines and torpedoes. With these weapons alone she may defy a foreign navy and prevent the landing of a foreign army upon her soil. And to cap the climax forced upon us by the advent of modern weapons, is it not clear that China or any other weak nation in the world can protect itself from aggression from overseas without the necessity of building a single battleship or cruiser? Is it not manifest that air power and submarine power, if provided in overwhelming strength, will absolutely dominate in war—will they not control the surface of the land and sea in future wars?

The New Era in War

The time has come for conservatism to open its ears and eyes and begin to hear and see. Military and naval policies must be built upon the rock of new inventions and upon the inevitable development of recent weapons in the near future. And with the limitation of armies and navies in overseas war, statesmen must begin to modify the tyranny of their methods by modernizing their minds. Their demands upon the weak nations beyond seas must be limited hereafter. Force does not carry across the ocean as irresistibly as it once did. Strong nations are curbed and weak nations are vastly strengthened by recent happenings. The defense has triumphed over the offense in intercontinental war. We may say without exaggeration that the Chinese empire by the intelligent use of air forces, mines and submarines alone can protect itself from attack by sea as

surely as did the Great Wall protect it from the hordes of the north armed with bows and arrows in ancient days.

There is nothing sensational in these statements. There is nothing new. We have known for months, if not for years, that ships at anchor or in rivers where they cannot zigzag are at the mercy of aircraft. The incidents of the Ostfriesland and the Chinese gunboats are mere bombs that should arouse conservatism from its trance.

In stressing the value of new weapons we do not justify the scrapping of our present fleet nor the reduction of our navy personnel. Not at all. Pacifists and "little navy men" cannot seize upon these modern truths as an argument for abolishing our navy.

A Three-Plane Navy

We cannot swap horses in the middle of the stream. We cannot throw away one weapon until a better is provided. The Monitor and the Merrimac proved in 1862 that wooden ships were useless against armored ships. And yet we continued to build wooden ships for twenty years and built no steel ones. There is always a period of transition.

No nation has a modern naval air force at present. It will require at least ten years for the United States to provide itself with new weapons. The Washington conference decided aright. Its decrees were righteous and wise. It stopped a foolish and wasteful race.

The navy as it exists today must be manned, mobilized, trained and kept ready for war. It must be developed gradually into a "Three-Plane Navy." The air, the surface and the sub-surface must be included. In a few years we can re-evaluate the weapons on these three planes. We have stopped building battleships. But we must keep what we have and build up our air forces and submarines.

In bombing conservatism we do not nurture something worse—pacifism! There is reason in all things.

WICHITA FALLS MEET

A VERY successful aviation meet was held at Wichita Falls, Texas, on April 29th, May 6th and 7th. The program for the three days' meet was as follows:

April 29th

1:00 P. M.—Battle formation by government planes.

Curtiss 30-Mile Race

A. I. Foster, Dallas, Texas, 1st place; 19 minutes 6 seconds. B. Good, Dallas, Texas, 2nd place. Berrell Tibbs, Wichita Falls, Texas, 3rd place.

Five-Minute Altitude Climb by Government Planes

W. H. Colby of Post Field, 1st place, reaching an altitude of 3,000 feet. Other contenders in this event were, Lieut. Saultz, Lieut. Brookley, Lieut. Wagner, and Lieut. Davis, all with DH planes. Lieut. Brookley gave one of the most daring exhibitions ever witnessed, doing

every kind of a stunt known in aviation.

Major Lohman, Commandant of Post Field, headed the 30 pilots and mechanics who attended the Meet in 15 machines from Fort Sill, Oklahoma. He expressed himself as highly pleased with the Meet.

Capt. Griffin, Official Photographer of Post Field, attended the Meet, and during the afternoon took several movie films of the contests and exhibitions.

Major Lohman made clear the fact that the army pilots were not competing with civilians in the Meet and that their visit was only a part of their drilling and because of their natural interest in Meets of this kind.

Wing Walking by Ed Lirett, Dallas, Texas

Lirette gave one of the most daring exhibitions ever seen in the South.

Laird Swallow and Lincoln Standard 30-Mile Race

W. H. Beech, Wichita, Kansas—Laird Swallow—1st place—time 17 min. 30 sec.

K. R. Garver, Attica, Kansas—Laird Swallow—2nd place.

E. M. Laird, Wichita, Kansas—Laird Swallow—3rd place.

Free-for-all Acrobatic Contest

Erret Williams, Arkansas City, Kansas—Curtiss—1st place.

M. M. Merrill, Dallas, Texas—Curtiss—2nd place.

B. Good, Dallas, Texas—Curtiss—3rd place.

Parachute Spot Landing Contest—1500 Feet

Frank Armstrong, Ponca City, Okla.—1st place.

Ed Lirette, Dallas, Texas—2nd place.

C. B. Bretel, Dallas, Texas—3rd place. Miss Mystery also made a high-class parachute jump.

Second Day—May 6

Formation Flying over the city.

30-Mile Curtiss Race

H. Foster, Dallas, Texas—Curtiss—1st place—time 20 min. 14 sec.

B. Good, Dallas, Texas—Curtiss—2nd place.

Chas Matherly, Wichita Falls, Texas—Curtiss—3rd place.

Wing walking by Ed Lirette and Frank Armstrong.

Laird Swallow—Lincoln Standard 12 Mile, Two-Turn Race

W. H. Beech, Wichita, Kansas—Laird Swallow—1st place—time 7 min. 6 sec.

E. M. Laird, Wichita, Kansas—Laird Swallow—2nd place.

K. R. Garver, Attica, Kansas—Laird Swallow—3rd place.

Free-for-all Acrobatic Contest

Erret Williams, Arkansas City, Kansas—Curtiss—1st place.

W. H. Beech, Wichita, Kansas—Laird Swallow—2nd place.

B. Good, Dallas, Texas—Curtiss—3rd place.

Parachute Spot Landing Contest—1500 Feet

Ed Lirette, Dallas, Texas—1st place.

C. B. Bretel, Dallas, Texas—2nd place.
Frank Armstrong, Ponca City, Okla.—3rd place.

Third Day—Sunday—May 7

Battle Formation Flight over city.
Parachute Jump by C. B. Bretel.

American Legion Free-for-all Handicap Race

W. H. Beech, Wichita, Kansas—Laird Swallow—1st place—time 21 min.

H. Foster, Dallas, Texas—Curtiss—2nd place—time 21 min. 13 sec.

B. Good, Dallas, Texas—Curtiss—3rd place—time 21 min. 18 sec.

Wing Walking Exhibition by Ed Lirette.

Spot Landing Contest with Dead Motor

W. H. Beech—Laird Swallow—1st place.

Cyle Horchem, Kansas—Laird Swallow—2nd place.

Erret Williams, Arkansas City, Kansas—Curtiss—3rd place.

Looping Contest

W. H. Beech, Wichita, Kansas—Laird Swallow—1st place—23 loops.

Cyle Horchem, Kansas—Laird Swallow—2nd place.

K. R. Garver, Attica, Kansas—Laird Swallow—3rd place.

Upside-down Flying Contest

Cyle Horchem in Laird Swallow—1st place.

Dick Phillips in Laird Swallow—2nd place.

Parachute Jump by Miss Mystery.

Sgt. Encil Chambers, holder of the World's altitude record for parachute jump, closed the meet making a 13,000 foot jump in the 30-mile wind.

The judges for the Meet were Pilot Pat Murphy, Dallas, Texas; Pilot J. G. Howard, Wichita Falls, Texas; Pilot B. Lopp, Wichita, Kansas.

On the return from this meet from Wichita Falls, Texas, to Wichita, Kansas, a distance of 300 miles, two Laird Swallows made the trip on a non-stop flight 2 hours and 50 minutes, piloted by E. M. Laird and W. H. Beech.

NOTES ON PROPELLER DESIGN—III

The Aerodynamical Equations of the Propeller Blade Elements

By MAX M. MUNK

(Technical Note National Advisory Committee for Aeronautics)

Summary

THE air flow and the air force created by all elements of the propeller blades lying in a ring located between two concentric circles around the propeller axis are independent of what happens in other rings. The aerodynamic equations of such blade elements are established and their application is discussed.

Since the air forces of well-designed propellers are uniformly distributed along the blades, the blade elements in each concentric ring around the propeller axis have properties practically independent of those in other rings. Hence the design or the analysis of a propeller has to be performed by designing or analyzing consecutively the elements of a number of such rings. I proceed immediately to the discussion of this problem.

One such short piece of the blade is generally considered as a wing moving on a spiral path. The angle of each blade element may always be measured from its direction of zero lift. There are two important angles: The angle ϵ of inclination to the propeller plane and the angle β of attack relative to the air. The air force of the blade element has one component in the direction of the relative motion and another one at right angle to it. The former is due to the viscosity of the air and will be considered later. It is small in general and does not materially alter the character of the air flow, but it can by no means be neglected. It may be called drag, and the other force may be called lift. By dividing the lift by the area of the blade element and by the dynamical pressure of the relative velocity between blade element and air, a lift coefficient C_L may be defined. The lift coefficient thus obtained obeys the laws established in the ordinary wing theory for infinite aspect ratio. In particular, it is never different from $2\pi\beta$.

The lift of the blade element, the relative velocity between it and the air, and the absolute velocity of the blade elements may be divided into components parallel and at right angles to the propeller axis. The components of the relative velocity may be written u and v , and those of the absolute velocity, U and V , where v and V are parallel to the axis. It may be assumed that V at the same time is the velocity of flight. The two components of the lift may be called thrust T and tangential force P . Let δ finally be the angle between the direction of the lift and the axis, so that

$$T = L \cos \delta, \quad P = L \sin \delta, \quad v/u = \tan \delta.$$

The angle of inclination of the blade element to the plane of the propeller is then

$$\epsilon = \delta + \beta.$$

The problem is to deduce the values of U and V if δ , C_L , u , and v are given. This is done by the application of the momentum theorem. The mass of air to which momentum is imparted is the mass of air passing the ring of radius r and breadth dr with the velocity v . Hence it is per unit of time

$$2\pi r dr v \rho.$$

Momentum is imparted by both the thrust and the tangential force, and it has to be assumed that half the total gain in velocity has been made when the air passes the propeller. Therefore, half this gain in velocity is

$$v \frac{it}{2\pi r} \frac{C_L}{4} \cdot \frac{1}{\sin \delta} \text{ in the tangential direction, and}$$

$$v \frac{it}{2\pi r} \frac{C_L}{4} \cdot \frac{\cos \delta}{\sin^2 \delta} \text{ in the axial direction, where } i \text{ denotes the number of blades and } t \text{ the breadth.}$$

Hence, writing m for

$$\frac{it}{2\pi r} \frac{C_L}{4}.$$

$$(1) \quad V = v(1 - m \cos \delta / \sin^2 \delta).$$

$$(2) \quad U = u(1 + m / \sin \delta).$$

From which it follows that

$$(3) \quad \frac{V}{U} = \frac{1 - m \cos \delta / \sin \delta}{1 + m / \sin \delta} \tan \delta.$$

The propeller coefficients, defined by

$$C_T = \frac{T}{2\pi r dr V^2 \frac{\rho}{2}} \quad \text{and} \quad C'_Q = \frac{P}{2\pi r dr V^2 \frac{\rho}{2}}$$

therefore is

$$(4) \quad C_T = \frac{4m \cos \delta}{(1 - m \cos \delta / \sin^2 \delta)^2}$$

$$= C_T \tan \delta.$$

There remains still the drag to be considered. Its influence on the thrust and the acceleration can be neglected. The efficient C'_Q is increased by

$$C''_Q = \frac{4m \cos \delta C_D / C_L}{(1 - m \cos \delta / \sin^2 \delta)^2}$$

as follows from the consideration of the tangential component of the drag $i \cos \delta$ and by applying the same conditions as before. Hence the complete efficient of the tangential force is

$$(5) \quad C_Q = \frac{4m \cos \delta}{(1 - m \cos \delta / \sin^2 \delta)^2} (C_T + C_D / C_L).$$

The equations thus obtained are sufficient for the design and the analysis of a blade element, but they are not yet in such a form that they can be used conveniently. For this purpose the equations have to be transformed. For purpose of design, generally C_T , C_L and V/U

given, and also the number of blades. From CL , β and C_p can be derived directly from the knowledge of the wing section and are to be considered as known too. The three unknown quantities to be determined are the breadth of the blade element, t , its angle of inclination, ϵ , and C_Q , the coefficient of the tangential force. These can easily be found if the two quantities δ and m are known. They are to be determined first. From equation (3):

$$(6) \quad m = \sin \delta \frac{\tan \delta - V/U}{1 + V/U}$$

This may be substituted in equation (4)

$$C_T = \frac{4 \sin \delta \cos \delta \frac{\tan \delta - V/U}{1 + V/U}}{\left(1 - \frac{\tan \delta - V/U}{\tan \delta (1 + V/U)}\right)^2 \sqrt{\dots}}$$

or, otherwise written

$$(7) \quad \tan \delta = V/U + \tan \delta (1 + V/U) \left\{ 1 + \frac{2 \sin^2 \delta}{C_T} - \sqrt{\left(1 + \frac{2 \sin^2 \delta}{C_T}\right)^2 - 1} \right\}$$

The negative value of the square root has to be taken, because otherwise, if C_T is small, the second term on the right hand side becomes very great.

This equation now can be used for the determination of $\tan \delta$. It is true that the right hand side contains the unknown quantity too, but it contains it in such a way that its value is not greatly affected by a small error in $\tan \delta$. The procedure is therefore to estimate $\tan \delta$ at first. It is slightly greater than V/U , say 10% for high velocities of flight and 20% for low speeds. Hence 1.1 to 1.2 V/U is to be substituted for $\tan \delta$ in the right hand side of the equation, thus giving a second improved value for $\tan \delta$. Often this improved value will be close enough to the first estimation and to the final result. If not, this improved second approximation may be substituted in the right hand side of equation (7) giving a third improved approximation, and so on.

After the determination of δ m is found by substituting δ in equation (6). Finally,

$$(8) \quad t = \frac{4m}{CL} \frac{2 \pi r}{i}$$

$\epsilon = \beta + \delta$ and C_Q can be found by substituting m and δ in the right side of equation (5).

Thus all quantities needed for purposes of design are determined.

The analysis of a given blade element, that is, the calculation of the air force if the width of the blade element, t , its inclination, ϵ , and its velocity, U/V , are given, is performed similarly. The same equations are to be applied of course. It

may be assumed that U/V , ϵ , and $\frac{i t}{2 \pi r}$

are given. In addition, the relation between β and CL must be known and may be assumed to be

$$CL = 2 \pi \beta$$

C_T and C_Q are to be determined. In order to be able to determine them, δ and m are calculated first.

The three equations for the determination of the unknown quantities are now

$$m = \frac{i t}{2 \pi r} \frac{CL}{4}$$

$$\delta = \epsilon - \frac{CL}{2 \pi}$$

$$V/U = \tan \delta \frac{1 - m \cos \delta / \sin^2 \delta}{1 + m / \sin \delta}$$

with the three unknown quantities m , δ , and CL .

The first equation can be written

$$CL = 4 m \frac{2 \pi r}{i t}$$

and this can be substituted in the second equation, giving

$$\delta = \epsilon - \frac{2m}{\pi} \frac{2 \pi r}{i t}$$

Apply the function \tan on both sides, taking into consideration that the last term is small

$$\tan \delta = \frac{2m}{\pi} \frac{2 \pi r}{i t} \tan \epsilon$$

$$1 + \frac{2m}{\pi} \frac{2 \pi r}{i t} \tan \epsilon$$

or transformed

$$m = \frac{\tan \epsilon - \tan \delta}{\frac{2}{\pi} \frac{2 \pi r}{i t} (1 + \tan \epsilon \tan \delta)}$$

Now the value of m , as derived from the third equation, is given by equation (6). The two expressions have to be equal and hence they give an equation which contains only the one unknown quantity $\tan \delta$. The resulting equation can be written.

$$(9) \quad \tan \delta = \frac{\tan \epsilon (1 + V/U) \sin}{(1 + V/U) \sin}$$

$$\delta + V/U \frac{4 r}{i t} (\tan \epsilon \tan \delta + 1)$$

$$\delta + \frac{4 r}{i t} (\tan \epsilon \tan \delta + 1)$$

This equation can be used for the determination of $\tan \delta$ in the same way as was equation (6). $\tan \delta$ has to be assumed to have a value between $\tan \epsilon$ and V/U .

If $\tan \delta$ is found CL is quickly calculated by means of

$$(10) \quad CL = 2 \pi (\epsilon - \delta)$$

and

$$(11) \quad m = \frac{i t}{2 \pi r} \frac{CL}{4} = \frac{i t (\epsilon - \delta) \pi}{2 \pi r}$$

and thus all quantities occurring in equations (4) and (5) are known and, being substituted, will give the values of C_T and C_Q .

I wish to add some remarks referring to the actual solution of equations (7) and (9). The determination of $\tan \delta$ can be made in less than one minute if the following rules are observed.

In both equations occur $\tan \delta$ and $\sin \delta$ and it would take too much time to look

for $\sin \delta$ in a table after $\tan \delta$ is given or assumed. The sine can be determined from the tangent much more quickly by means of the slide rule. For

$$\sin \delta = \frac{\tan \delta}{\sqrt{1 + \tan^2 \delta}}$$

This can be solved by one move of the runner and the rule. The reader is requested to take his slide rule and to compute the following example in order to convince himself how much more quickly he can perform the calculation than I can explain it. (See figure.)

Suppose, for example, that $\tan \delta = .40$. Place the runner on the graduation .40 of the lower scale D. Then the runner indicates .16 on the upper scale A. Add 1 to this: 1 + .16 = 1.16 and move the rule so that its upper scale B shows this 1.16 under the mark of the runner. Then the left end of the runner gives $\sin \delta = .372$ on the lower scale D and $\sin^2 \delta = .138$ on the upper scale A.

In the solution of equation (7), the following expressions are to be computed, in the order given, by means of the slide rule: Given V/U , C_T , and $\tan \delta$, approximately

$$(a) = \frac{2 \sin^2 \delta}{C_T}$$

$$(b) = 1 + (a)$$

$$(c) = \sqrt{(b)^2 - 1}$$

$$(d) = (b) - (c)$$

$$(e) = \tan \delta (1 + V/U) \cdot (d)$$

$$\tan \delta = V/U + (e)$$

If (b) is considerably greater than 1, (d) has the value

$$\frac{2 (b)}{4 r}$$

For the solution of equation (9): Given

$$V/U, \tan \epsilon, \frac{4 r}{i t} \text{ and } \tan \delta \text{ approximately}$$

(it lying between V/U and $\tan \epsilon$).

$$(a) = 1 + \tan \epsilon \tan \delta$$

$$(b) = (1 + V/U) \sin \delta$$

$$(d) = \frac{4 r}{i t} (a)$$

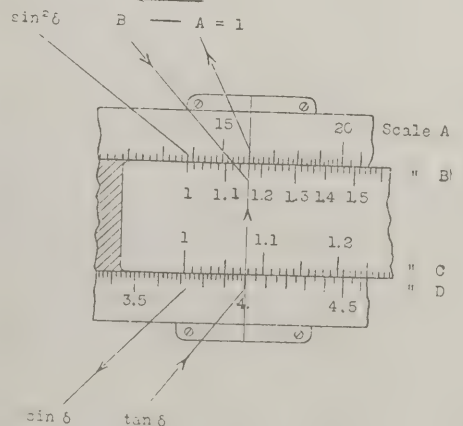
$$(f) = (b) + (d)$$

$$(c) = \tan \epsilon (b)$$

$$(e) = V/U (d)$$

$$(g) = (c) + (e)$$

$$\tan \delta = \frac{(g)}{(f)}$$





Where Wright Aeronautical Engines Are Made

EAGE

A
SCRIPTION

IPMENT

Approximately 7 acres, located on Main Line of Erie Railroad.

90,000 square feet.

Four floors, size 75 ft. by 300 ft. Concrete and steel heavy mill type construction, 250 pounds per square foot loading.

The plant is equipped at present to produce, and is producing approximately 300 engines per year, with spare parts therefor, and has ample capacity in addition to provide adequately for all spare part requirements for all types of engines previously produced. The equipment of the plant provides for the complete manufacture of various type engines produced, including bronze and aluminum castings, except bar steel and drop forgings. The capacity of the present plant could be expanded to produce engines at the rate of five per day in the present building. In an emergency the present acreage would allow of enough additional buildings and equipment being provided within six to eight months to produce engines of any one type in quantities of at least 25 per day.

The plant has employed during the past year an average of 450 people, which includes a complete Engineering Department and Experimental Shop.

WRIGHT AERONAUTICAL CORPORATION

Paterson, New Jersey, U. S. A.



THE BOOTHBY GAS ARMORED TANK

THE Boothby Gas Armored fuel tank, which gave extraordinarily good results in the recent British Air Ministry crash-proof tank tests, is an entirely new departure in aircraft tank construction. The design is based on Commander F. L. M. Boothby's observations that ballast bags dropped from airships did not burst badly on hitting the ground, especially if the bags were not full, combined with the result of tests made to fireproof gas bags by surrounding them with a layer of inert gas.

The tank is a fabric tank, and consists of an inner skin of balloon fabric, lined within with gold-beater's skin, a second container also of fabric, which serves as a safeguard in the event of the inner case leaking, and finally of an outer gas-tight casing filled with cooled exhaust from the engine.

This outer case may be of fabric or three-ply, and it is possible to use the fairing of the fuselage itself as part of this outer casing.

The two inner casings are supported from the fuselage on rubber shock absorbers, and to prevent swaying it is also suspended by light cords. These latter are so light that they will carry away in a crash before damage is done to the casing.

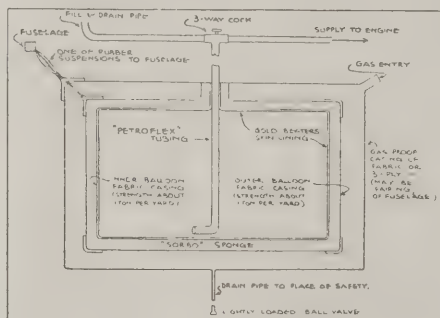
The design of petrol connections for a crash-proof tank presents difficulties, for they are very liable to break in a crash, and a broken petrol pipe may be as dangerous as a punctured tank. In the Boothby tank there is a single sleeve passing through the top of the whole assembly. Into this fits tightly a length of smooth "Petroflex" tubing which reaches to the bottom of the tank, but which is only friction held in the sleeve, and can therefore pull through to a considerable

extent if the tank carries away.

The outer casing is kept filled by exhaust gas taken from the engine through a small pipe long enough to cool the gas. The bottom of the gas compartment has an escape and drain pipe, fitted at its end with a lightly loaded release valve, and leading down to the undercarriage or some such place of safety. Thus the gas case is kept charged with exhaust, and if there is any petrol leakage from the inner casings the petrol is also drained off to a place of safety.

In the latest type of this tank the space between the two inner casings is filled with "Sorbo" sponge, which if punctured, as by a bullet, will swell on contact with petrol and close the hole.

The tank entered in the Air Ministry competition was not fitted with this sponge filling, and originally the Air Ministry agreed to allow the fairing of the fuselage to be used as a gas casing. The tank was designed to carry the specified quantity of 31.5 gallons, but as this type of tank requires to be only partially full to give the full extent of safety it was actually capable of being filled to over 50 gal-



lons, though it would not then have been crash-proof.

In the preliminary crash tests the tank did not leak at all, and was quite fit to repeat the test. About a week before the final tests the Air Ministry withdrew the concession that the fuselage fairing might be used as a gas container, and also said that if the tank was capable of containing more than 31.5 gallons it must be disqualified under the rules of the competition. There was not time to design and build new tanks, so extemporized means were taken to reduce the volume, the outer casing was removed, and a rough gas casing was built inside the fuselage. The result was not as good as the original design. The crash-proof qualities were about half those of the original and the fireproof qualities were small. Nevertheless it stood five rounds of incendiary ammunition and only failed after 10 rounds through one point of aim.

The sketch attached shows the general scheme very clearly. The single Petroflex tube leading out of the tank is connected to a three-way cock, so that one may either fill, drain, or supply the carburetor through it. The tank could be used for gravity feed, after starting a siphon action, or for petrol pump feed.

It may also be used for pressure feed. In this case, owing to the flexible nature of the tank, pressure may be applied outside, thus avoiding the risk of pumping impurities into the petrol container.

Finally it is a distinctly valuable feature that using this construction a crash-proof tank can be built for considerably less than that of the ordinary unprotected tinned steel type. The weight of the crash and fireproof type can be brought down to practically the same weight as the usual type.

Sioux City Bankers Travel by Air

Sioux City.—A delegation of bankers from Sioux City attended the meeting of the South Dakota Association of Bankers at Winner, S. Dak., May 18, by aeroplane. The large SVA passenger ship was furnished by the Curtiss-Iowa Air Craft Corporation.

The economy of traveling by air was quickly realized by these bankers, who are able to save time as well as travel in comfort. The trip, if made by train, would require two days of travel, the train leaving Sioux City at 8:40 in the morning, arriving at the South Dakota point at 9:30 p. m. The return trip would necessitate day travel from 4:30 a. m., Friday, until 5:20 p. m. The bankers left Sioux City on a 160-mile air line route at 4 o'clock Wednesday afternoon, arriving at Winner at 5:30. After attending the conference Thursday they returned home the same evening.

Aviation is making great headway in the Seventh Corps Area since the District Conference in March. Extensive plans are under way for regular air service between the largest cities, and the Aero Club of Sioux City is co-operating with the Curtiss-Iowa Air Craft Corporation for extending their lines. A line is planned from Sioux City to Chicago via Fort Dodge and Cedar Rapids, which is expected to be in operation within thirty days. During the Summer months lines will be extended to Sioux Falls, S. Dak., Omaha, Neb., and Kansas City, Mo. Final plans are for developing a line from Sioux City to the Pacific Coast points.

The Aero Club of Sioux City is one of the largest and most active in America. A fully equipped landing field will be ready

in June for transportation lines as well as several privately owned ships. In addition to their local work they are taking an active part in the Seventh Corps Area Association as well as the National Organization work.

The Tail Plane

This report (No. 133) by Max M. Munk of the National Advisory Committee for Aeronautics deals with the calculation of the tail plane. The author has tried to simplify the present theory of longitudinal stability for that particular purpose so as to obtain one definite coefficient characteristic of the effect of the tail plane.

This coefficient is obtained by substituting certain aerodynamic characteristics and some dimensions of the aeroplane in a comparatively simple mathematical expression. Care has been taken to confine all aerodynamical information necessary for the calculation of the coefficient to the well-known curves representing the qualities of the wing section. This is done by making use of the recent results of modern aerodynamics. All formulas and relations necessary for the calculations are contained in the paper. They give sometimes only an approximation of the real values. An example of calculation is added in order to illustrate the application of the method.

The coefficient indicates not only whether the effect of the tail plane is great enough, but also whether it is not too great. It appears that the designer has to avoid a certain critical length of the fuselage, which inevitably gives rise to periodical oscillations of the aeroplane. The discussion also shows the way and in

what direction to carry out experimental work.

A copy of Report No. 133 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

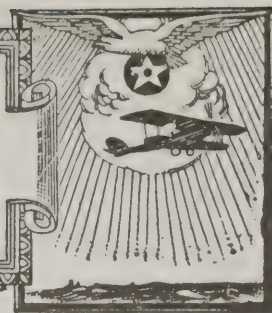
New Service Publications

Plain Talk, published weekly at the U. S. Naval Air Station, Coco Solo, C. Z., by the officers and enlisted personnel on duty there, is among the latest additions to the numerous Service papers published ashore and afloat. Lieut. H. B. Leggett, Jr., U. S. N. R. F., is editor-in-chief, while Lieut. A. R. Tilburne, U. S. N. R. F., is one of the "chief reporters." There is an excellent editorial concerning the Panama Canal and its importance and the need for its complete state of defense in the event of an emergency arising. It asserts that in daily conversation among those in both branches of the Service in the Canal Zone the question is often asked, "Is the Canal well protected?" In addition to interesting news of the station there are many clever and humorous articles, among them "Daily Routine Aboard a Soviet-Run Battleship," "Fylosophy of Life" and "The Fable of the Wise Guy and the Navy Spirit."

Another new Service publication is *Wind Aloft*, published weekly at Ross Field, Arcadia, Cal., by the personnel of the Air Service, U. S. A., stationed there. Lieut. James M. G. T. Neely, U. S. A., is editor-in-chief and Lieuts. George G. Cressey and W. J. Flood, U. S. A., are assistant editors. The first number consists of six mimeographed pages. It contains much news of the commissioned and enlisted personnel and of other matters concerning the station.



NAVAL *and* MILITARY AERONAUTICS



Student Fliers Graduate from Carlstrom Field School

The following graduate student officers from the primary flying school at Carlstrom Field received their orders for advanced training and departed for their new stations: Lieut. Aubry Strickland to Ellington for pursuit training; Lieuts. A. Clements, R. R. Clark, C. Shangraw and L. T. Whitten to Kelly Field for bombing; and Lieuts. J. C. Dickson, D. W. Goodrich, K. A. Kemmer, P. G. Wehle, Williamson and Hensinger to Fort Sill for observation training.

Locating New Landing Fields

Orders in effect at the Fairfield Air Intermediate Depot, Fairfield, O., require that all pilots make at least one cross country flight each month for a distance of not less than 100 miles, and that during the course of these flights they will endeavor to locate a desirable landing field, preferably a "local landing field" near some important town. If the field in question is deemed of sufficient importance the pilot will fill out a questionnaire giving particulars concerning same. This is considered a good policy and, if adopted generally, should tend to improve present conditions with regard to shortage of landing fields.

Colonel Truby Leaves the Air Service

Colonel Albert E. Truby, Medical Corps, succeeded recently by Lt.-Colonel William R. Davis, Medical Corps, as Chief of Medical Section in the Office of the Chief of Air Service, has assumed command of the Letterman General Hospital, Presidio of San Francisco, California.

During his three years of service in the Office of the Chief of Air Service, Colonel Truby's efforts in the medical field of aviation were productive of excellent results. Through his efforts the Medical Research Laboratory, Mitchel Field, L. I., New York, where the School for Flight Surgeons is conducted, became a recognized special service school last year.

Colonel Davis has spent the past three months at the Medical Research Laboratory, and will assume active charge of the Medical Section about May 1st.

General Mitchell Visits Mitchel Field

Brigadier General William Mitchell, Assistant Chief of Air Service, accompanied by 1st Lieut. L. J. Maitland, Air Service, arrived at Mitchel Field by air from Bolling Field on Friday, April 21st. The general spent several days at Mitchel Field and vicinity inspecting the sites of several aircraft corporations. He flew to all outlying stations, among them the plant of the Thomas-Morse Aircraft Corporation, Teterboro, N. Y., and the Witmore-Lewis Aircraft Corporation at Hasbrouck Heights, N. J.

Air Service Squadrons Depart for Panama

The 24th Squadron (Pursuit) consisting of three officers (Captains William E. Arthing and Norbert Carolin and Lieut. Arthur K. Ladd) and 125 enlisted men,

and the 25th Squadron (Bombardment), consisting of three officers (Major Norman J. Boots and Lieutenants Cornelius J. Kenney and Edward E. Hildreth) and 126 enlisted men, departed from Mitchel Field for service in Panama on the morning of April 22nd, and sailed from the Army Base on the U. S. Army Transport *Somme* in the afternoon of the same day. The departure of these squadrons reduces the garrison of Mitchel Field by about one-third.

While at Mitchel Field these squadrons had no regularly assigned flying equipment and were strictly engaged in securing individual and organization property, and in training the men in duties incident to foreign service. Prior to the departure of these two organizations, they were inspected on several occasions by the Commanding Officer of Mitchel Field in an effort to determine their exact status as to whether or not they were conditioned in every way for departure for service in the Canal Zone. Reports of these inspections indicate that both organizations left in good condition. Mitchel Field regrets to lose these two organizations, particularly so since many of the older noncommissioned officers and valuable enlisted specialists went with them.

New Test Pilot for the MB-7

Captain Mulcahey, of the Marine Corps, has arrived at Mitchel Field and relieved Lieut. Fleer as test pilot for the MB-7. Immediately upon his arrival, and almost daily since, Captain Mulcahey has flown this little plane. For the past few days he has been taking it over the measured course in an effort to determine its maximum racing speed. The course over which this plane has been flown lies over a portion of two neighboring villages, Garden City and Westbury. Captain Mulcahey has flown the plane rather low in order that he might stay directly over his pylons and not stray from the course.

Art. Smith Goes to McCook Field

The celebrated civilian aviator, Mr. Art. Smith, who has been testing out a new type of double-controlled training ship of his own design during the last few months at Carlstrom Field, left for McCook Field on Wednesday, April 19th. Mr. Smith's departure will be regretted by everyone with whom he came in contact at Carlstrom Field.

Pursuit Pilots Graduate

A class of eight student officers, training in advanced pursuit, were graduated at Ellington Field on Friday, April 23. Graduating exercises consisted of an aerial review by the commanding officer of the post and the Academic Board. Two formations of three SE-5's each and one formation of five SE-5's passed in review, after which they performed a series of maneuvers in formation. The following officers composed the class: Major E. H. Brainard, Marine Corps; Captain George C. Tinsley and Lieutenants Walter H. Reid, Claire L. Chennault, E. E. Glenn, John D. Barrigar, John K. Cannon and Donald F. Stace, Air Service.

Cross-Country Flying at Ellington Field

During the past week 23 officers of the First Group (Pursuit), Ellington Field, participated in three cross country flights, the flying time aggregating 105 hours. To date six cross country flights to Kelly Field have been successfully made in Thomas Morse pursuit planes. The gas capacity of this plane is just sufficient for this flight of 200 miles, the average time being one hour and forty minutes.

Kelly Field Aviators Assist in Celebration

Four formations of five planes each assisted in the annual celebration of the Battle of Flowers of the Fiesta, San Jacinto, on Friday, April 21. After flying for about an hour over the parade in San Antonio, the XBIA formation broke up over the Alamo and dropped floral bombs on this historic old building. The Attack Group entered as its representative in the parade a DH4B aeroplane stripped, mounted on a trailer and artistically decorated with streamers of the old and new Air Service colors, fully equipped with machine guns, bomb sights, generators and other general equipment required for attack planes. In large letters the words "Third Group (Attack)" formed an arc over the crest of the Third Group (Attack). The supervision of the float was under Staff Sergeant Floyd L. Parker, the designer of the Group's coat-of-arms.

Filipinos are Still Skeptical of the Aeroplane

The new flying field at Camp Nichols, Rizal, P. I., seems to be very popular, being used by pilots from Clark Field coming and going, in addition to the pilots of Camp Nichols. This makes it seem like old times, and what sweeter music could an Air Service man desire than the drone of a perfectly tuned Liberty? In spite of the fact that much flying is done in the immediate vicinity of this station, the natives still appear to be rather skeptical of the aeroplane and regard it as something strange and not regular in the course of human events. When a plane flies over their barrio they will stop whatever they are doing and run out and gaze at it as though it was some strange bird that has paid a visit to this material earth from some far distant planet. When a pilot banks or zooms his plane they fairly hold their breath—for how can it remain up and do the things it does? Recently a formation flew over Manila and the water front. It was certainly a pretty sight, for so perfect a formation did the pilots keep that it seemed from the ground that they were fairly riding on each other's tail.

Photographic Aeroplanes Nearing Completion

Fifteen DH4-BP1 aeroplanes, which the Engineering Department of the Fairfield Air Intermediate Depot, Fairfield, Ohio, is manufacturing for photographic purposes throughout the Air Service, are nearing completion. By the first of May it is contemplated having these ships all set up and awaiting final test. To date there have been three of this type of aeroplane tested at Fairfield with very satisfactory results.



FOREIGN NEWS



New Italian Secretary

The new Secretary of War, Principe di Scalea, is a well known competent in commercial aviation. He was President of the Inter-ministerial Commission of Aeronautics, a body charged with the control of the State Aeronautics. There is no doubt that Principe di Scalea will give the Army Air Service a new impulse, starting a new era, after last year's depression.

New Zealand Club

The Auckland Service Aero Club completed negotiations during February with the New Zealand Aero Transport Co. for the amalgamation of their interests in the Auckland district. The combined interests plan to link Auckland with Wellington by air and to establish branches from those points. Government cooperation will be enlisted in having regular air routes surveyed and plotted and suitable landing grounds established with the key airdrome at Auckland. Arrangements have already been made for the importation of three aeroplanes, and additional capital to the amount of £20,000 is being raised by subscription in Auckland for the erection of the airdrome.

—Commerce Reports.

Argentine Federation

A federation of the Argentine aero clubs has been organized under the name of the Federacion Aeronautica Nacional with the purpose of representing the general interests of aviation in Argentina and to encourage its development and organize trials, concours, expositions, and all aerial manifestations. Besides the Aero Club Argentino, the federation is affiliated with the aero clubs of the following places: Rosario, Cordoba, Corrientes, Santiago del Estero, Pergamino, Necochea, Tucuman, Santa Fe, and Balcarce.

British Subsidies

From April 1st the Handley-Page Transport, Instone Air Line, and Daimler Hire (Limited) will receive the air subsidy for their services on the London-Paris route under a new scheme. The new conditions are that the Government will pay a subsidy of 25 percent on the gross takings will provide not more than half the operating fleet on the hire purchase basis, and will give an additional grant until February 28, 1923, of £3 per passenger and 3d. per lb. of goods carried.

French Glider Trials

Trials of motorless airplanes are to take place on an extensive scale in the department of Auvergne, in central France, during the coming summer. Hitherto efforts in the direction of developing some kind of airplane capable of flying without the aid of a motor were generally regarded as having been left to Germany, but the French have now entered the field on a somewhat important scale.

The Municipal Council of Aydat, near the well-known lake of that name, has just authorized the Auvergne Aero Club to organize in the parish an airdrome for the use of the body formally known as the Experimental Congress of Motorless Aeroplanes, which is to be held there from July 15 to September 15 next. The hangars will be erected at the foot of the peak called the Puy-de-Pommegrasse. The motorless airplanes will "take off" from the top of the peak.

The South Atlantic Flight

We are indebted to our contemporary, the *Aeroplane*, for the following interesting data concerning the South Atlantic flight by the Portuguese aviators, Capitao Tenente (commander), Saccadura-Cabral, and Captain Gago-Coutinho, of the Portuguese Navy:

It will be remembered that the journey was begun from Lisbon at 07.00 hours on March 30th, and that the machine reached Las Palmas, in the Canary Isles, at 15.00 hours, having covered the 710 miles in 8 hours. There the flight was interrupted for several days. On April 5th the flight to St. Vincent in the Cape Verde Isles was completed, the distance of 845 miles being flown in some 9 hours.

Heavy gales blew at St. Vincent for the next 12 days, but on April 17th the weather changed. The machine was flown to Porto Praia, at the extreme southern end of the Cape Verde Islands, where it was filled up, and whence it departed on the next morning.

It was hoped that it would be possible to reach the island of Fernando Noronha, which is within 200 miles of the mainland of Brazil, but a Portuguese cruiser was stationed just off the St. Paul's Rocks, a group of very small islands just north of the Equator and some 250 miles short of the full stage, in order that if it were found impossible to complete the stage the night might be spent there.

From Porto Praia to St. Paul's is roughly 1,000 miles; the complete stage to Fernando Noronha is about 1,250 miles.

In the region between the Cape Verde Islands and the Equator the prevailing wind—and it is a wind which can be relied on with fair certainty—is northeasterly, and therefore more or less behind a machine making this trip. But in a belt which extends somewhat to the north of the Equator there is a prevalent wind from the southeast, across and to some extent ahead of the course. It would appear that the machine ran into this wind some considerable time before reaching St. Paul's, with the result that the machine did not arrive at that point till 18.00 hours in the evening, and that by that time the pilot was tired out.

It was in any case impossible to reach Fernando Noronha before dark. It was therefore decided to land at St. Paul's and spend the night on the cruiser.

Unfortunately in landing the machine was damaged—it is said owing to a cross-wind landing—and it was therefore impossible to continue the flight.

It is now announced that another seaplane—a standard Fairey 3D—is being dispatched to St. Paul's and that Commander Saccadura and his navigator, Captain Gago-Coutinho, will complete the voyage on its arrival. Despite the unfortunate accident at St. Paul's, this performance is extremely creditable to all concerned.

The three main stages, of which the shortest is over 700 miles, all represent very considerable achievements, particularly when it is recollected that they are made out of sight of land, and that the terminals in each case are quite small groups of islands. The last stage—of just on 1,000 miles, terminating on a group of rocks whose total area is about 20 acres,

with no other land within 200 miles or more—must be regarded as extremely fine piece of accurate navigation, particularly considering the very great strain necessarily imposed by something about 12 hours' continuous flying, all of it within the tropics.

Capitao Tenente Saccadura-Cabral, the pilot of the expedition, previously distinguished himself by his flight from Calshot to Lisbon, from Lisbon to Madeira, in an F-3 flying-boat which was purchased by the Portuguese Navy after having been reconditioned and equipped by the Fairey Aviation Company at their Hamble works.

Señor Saccadura succeeded in gaining the support of his Government in his effort to fly the South Atlantic to Brazil, and for this purpose definitely limited sum was placed at his sole disposal to cover the expenses of the journey. In his search for a suitable machine he visited the leading aircraft factories of Europe, and after consideration of all proposals made to him by them decided to entrust the manufacture of a machine to the firm who had equipped the F-3 which he had used on previous journeys.

The order to build the machine was given to the Fairey Aviation Company under a strict guarantee that the machine should be completed as flown, at the specified load, and should show the specified performance within three months of the date of the order. This guarantee was fulfilled to the day.

The machine is a modification of the Standard Fairey 3-D type, fitted with enlarged floats, increased wing span, and with fuel tanks for 10 hours' flight at cruising speed.

The span is 62 ft., the total loaded weight is 7,250 lbs., and as the engine is a Rolls-Royce of 360 h.p. the weight per h.p. is over 20 lbs.

Of this total the disposable weight is 3,100 lbs. At this weight the machine handles well both on the water and in the air, has a top speed of 95 m.p.h., and an initial climb of 350 ft. per min.

The machine is, of course, fitted with the Fairey variable camber gear. Her actual performance on the trip is clear proof of the extremely good qualities of the machine and of the faultless running of the engine, and both the Fairey Company and Rolls-Royce, Ltd., have every reason to be proud of the results achieved.

The crew of the machine also deserve to be congratulated on an extremely fine performance. Commander Saccadura-Cabral is both an experienced pilot and a capable navigator. This performance marks him as being possessed of a courage and endurance which show him to be a worthy descendant of the Portuguese navigators and explorers of the Middle Ages.

Captain Gago-Coutinho is, one believes, a quite elderly officer who is not a pilot. He has previous experience of aerial navigation—he accompanied Commander Saccadura to Madeira on the F-3—and his subsequent achievements prove that this early success was no mere fluke.

On the Madeira trip a Portuguese ship was stationed halfway along the route as a mark boat. The F-3 sighted the ship and passed it some five miles to the south and east. It is related that when the crew of the F boat encountered the skipper of the mark boat each reproached the other for being five miles off the proper course. It was eventually discovered that the ship was on the true course from the mouth of the Tagus while the F boat had flown from the Tagus above Lisbon, and that each of them was actually on its correct course.

An ordinary marine sextant, together with a drift indicating corrector designed by Commander Saccadura, used in conjunction with smoke bombs dropped on the water, were used for navigating purposes.

Italian Aeronautics

Prize Piemonte. Under the patronage of the "Federazione Aeronautica Nazionale Italiana" and by initiative of other aeronautical associations an international competition for commercial aeroplanes is to be performed in the last week of the month of June, 1922. The course is to be 3 times the circuit bounded by the cities of Turin-Cuneo-Alexandria-Novara-Biella-Turin (683 miles). The competitors, besides the place of starting and arrival, will have the possibility of landing twice, being allowed to refurnish fuel. The classification will be settled by the following formula:

$$K = \frac{V_c}{V_{min}} \cdot \frac{P}{Q}$$

where Q indicates the commercial load of the machine expressed in kilograms; P the weight in kilograms of the petrol consumed in the competition; Vc the commercial speed represented in Kilometre-hour when with the machine performs the voyage; Vmin the smallest speed in Kilometre-hour which the machine can assume.

The aircrafts for which the value of Vc should result inferior to 120 Km. p. h. will not be allowed to compete for any prize. The commercial load must not be inferior to 300 kilograms, besides the weight of the pilot which is considered 80 kilograms for everybody.

As to the prizes for the moment it is known that a prize of £40,000 will be awarded to the firm builder of the machine finally classified, and a prize of £10,000 to the pilot of the aforementioned machine.

Aeronautics and Parliament. At the last votings by secret scrutiny the "Camera dei Deputati" has voted the bill for the constitution of a "High Council for the Aeronautics" and of a "Technical and Administrative Committee for the Aeronautics." The Council will be composed by the representatives of the various aeronautical categories, viz. industrial and technical staff, Corporations of Propaganda, and the Aeronautical Navigation Undertakings. With the institution of the above Council and Committee, the standing committee for the Aeronautics established with the Act No. 849, 1920, is to be suppressed. The bill will be presented to the "Senato" for the approval.

An Italian Mission for the Aeronautics will leave in a short time towards the Equator. Major Lombard is the commander of it.

The Firm Dornier in Italy. The Press hears from Leghorn that the Firm Dornier is about to be transferred to Leghorn and will occupy the works up to now belonging to the Firm Gallinari which they have been dissolved.

Marseilles-Monaco-Marseilles Race

This French seaplane contest was run off on April 19, when six naval and two civilian pilots took part. M. Eynac, Under-Secretary of State for Aeronautics, evinced the keenest interest in the event, and had flown in a Goliath from Paris to Marseilles in 5½ hours' flying time a couple of days previously, in order to be present at the start and finish. The finish found M. Poirée, on a 135-h.p. Clerget-Caudron, the winner in 5 hrs. 1 min., Brou on a Farman being second in 8 hrs. 14 mins.

ELEMENTARY AERONAUTICS and MODEL NOTES

CLUBS

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240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark,
Hotel Nortonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

THE JUNIOR CLUB OF AERONAUTICS,
KANSAS CITY, MO.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.
AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

FLIGHT ASSOCIATION OF OTTAWA, CAN.
c/o Mr. Oswald Barry,
117 Albert Street, Ottawa, Canada

Illinois Model Aero Club's Outdoor Contests for 1922.

THE following list of I. M. A. C. contests for the 1922 season indicates that there will be some spirited competition at the field. The first contest on the list was won by Edward Lange, whose model flew a little more than 4300 feet. There was practically no wind blowing at the time, the record is remarkable.

Contests are to be held on the following dates:

Hand-Launched Distance.....	April 23
Hand-Launched Duration.....	May 21
Rise-off-Ground Duration.....	June 18
Hydro Duration.....	July 9
Hand-Launched Duration.....	Aug. 20
Speed	Sept. 17
Rise-off-Ground Duration.....	Oct. 22

All outdoor contests with the exception of the fourth will be held at Ashburn Flying Field commencing at two o'clock on the days designated. The Hydro contest will be held at Lake Calumet.

Each contestant will be given three official flights which must be announced in advance.

Contestants residing outside the city limits of Chicago will be allowed to take their official flights under the rules which the Contest Committee has drawn up to govern such action.

The following awards are to be made to contest winners:

1. *Cross-Country aeroplane ride with Major Schroeder.*
His flight will be approximately 150 miles long.

To be given as first prize for the best average in the first three outdoor contests of 1922.

- 1.—H. L. Distance
- 2.—H. L. Duration
- 3.—R. O. G. Duration

2. *A snappy ride over the flying field with "Buck Weaver."*
To be given as first prize in the Hydro contests.

3. *Cross-Country ride with Mr. Elmer Partridge.*

To be given as first prize for the best average in the last three contests of the year.

- H. L. Duration
- Speed
- R. O. G. Duration

4. *An "A" frame model, offered by Mr. R. Jaros.*

To be given to the person having the second best average in the first three contests.

5. *Ten Dollars will be given by Mr. Pease.*

For the first steam or gasoline flight of over 30 seconds.

6. *Fifteen Dollars will be given by Mr. Lathrop.*

For the first flight by any type of model over 300 seconds.

7. *Two short rides to be given by Elmer Partridge over the Aero Club of Illinois' Flying Field.*

To be given as first and second prize for the best amateur averages in all outdoor contests of the year.

8. *The handsome Laird-Weaver trophy will be given as usual.*

To the person having the best average in all the contests of the year.

9. *Two books of model plans.*

To be given to the Out-of-Town members having the first and second best average in all the outdoor contests.

Motorcycle Engine "Aeromobile."

Lots of aeroplane thrills on the ground is one of the features of the "Aeromobile," a machine invented by Edgar W. Croft, a newspaperman at Zion, Illinois. This machine has considerable speed and climbs hills with as much ease as any automobile. On a straight run on a concrete road she develops enough speed to take off the ground; all that is required is the wings to make this possible. Parts from Curtiss aeroplanes were used in its construction. The seat, steering device, struts, tubing and wheels, all being aeroplane parts.

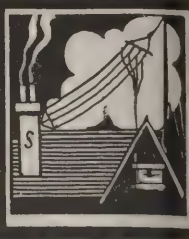
A motorcycle engine coupled up direct to a propeller forms the motive power, and a torpedo tank with four gallons capacity provides ample gas for long runs through the country, as the "Aeromobile" consumes very little gas in comparison to other motor vehicles. A novel feature is the brake, which consists of two large hardwood reels which clamp down on the tires when a foot-pedal is pressed. A steel tube guard just beyond the propeller tips protects the tips and prevents the possibility of accident to those standing near the propeller.



The Croft Aeromobile, made from aeroplane parts and a motorcycle engine



RADIO DIGEST



Ground and Plane Radio Demonstrations at San Antonio

Lieutenant Canfield, Communications Officer for the 2nd Bombardment Group at Kelly Field, recently demonstrated radio-phone communication between a plane and the ground. A radio truck was stationed in front of the Alamo, San Antonio, and from a large amplifier in the roof of the truck the voice from the plane overhead was heard clearly and distinctly by a large and interested audience. Along this line it may be said that Lieut. Schneider, Wing Communications Officer, is receiving a large number of letters of congratulations and thanks from points up to 800 miles away for the concerts and dialogues he has been giving on the new radio-phone recently received.

Broadcasting Station Delayed

Although Rodman Wanamaker, chairman of the special committee appointed to make plans for a municipal radio broadcasting station for New York City, urged the committee of the whole of the Board of Estimate to appropriate \$50,000 for the plant at once, the matter was laid over for another week.

"What are we going to do with it after we get it?" asked Julius Miller, President of the Borough of Manhattan.

There was no reply except that of Comptroller Craig, who suggested it would be valuable in sending out reports of the Board of Estimate.

The Comptroller expressed the opinion that such a plant if established should be under the control of the Department of Water Supply, Gas and Electricity rather than the Department of Plant and Structures, as suggested in the Wanamaker report.

Radio Directs Lake Ships

For the first time navigation on Lake Superior has been robbed of its terrors. On May 14 the first Naval radio compass station on the Lakes opened at White Fish Point to direct passing ships by wireless. At any hour the captain of a ship lost in the fog banks can call the radio station and ask his position. The reply will give the ship's direction from White Fish Point for the vessel's navigator to plot on his chart.

Within three weeks two more radio compass stations will open, one at Grand Marais, sixty miles west of White Fish Bay, and the other at Detour, at the mouth of St. Mary's River. When they are in operation the passing ships will receive their location from two of the stations and plotting those two lines on the chart the skipper will know his ship is at the point where the lines meet.

The graveyard of the lakes stretches from White Fish Bay to Grand Marais, the nearest port of refuge to the west. The sixty miles of desolate water, rimmed by sand dunes and lonely forests, has claimed an annual toll in ships and lives and cargo since navigation opened on the upper lakes. One vessel, a Canadian lighthouse tender, went down off White Fish Point in a storm a few weeks ago with ninety men.

Secrecy of Radio Messages Promised by John H. Hammond, Jr.

Gloucester.—John Hays Hammond, Jr., apparently has revolutionized radio communication by a new invention. He has perfected a comparatively simple apparatus to prevent any station from taking messages except those for which it is intended.

The same wave can be made to carry several messages at the same time, and, further, it is stated, both voice and code may be transmitted.

The new apparatus will allow a far greater number of stations to communicate over a limited number of wavelengths. Accidental interference from other stations is greatly reduced. Efficiency is increased. Atmospheric electricity, or static, is diminished in its effect upon the new system to such extent that the system may be operated under conditions when the standard radio apparatus cannot successfully receive.

Mr. Hammond's statement declares that he has been at work upon these problems for the past fourteen years. A demonstration was given today before officials and experts of one of the leading American radio companies, and Mr. Hammond says the United States Navy and War departments have given his latest discoveries exhaustive tests with success.

The system, it is declared, embodies a direct and simple means of insuring privacy, and it will be practically impossible under ordinary conditions for any other than the proper receiving station to hear anything but a jumble.

The Treasury Department was authorized in 1916 to set aside an appropriation of \$750,000 to acquire the patent rights of John Hays Hammond, Jr., in order to have the exclusive use of his researches and inventions in the line of the radio dynamic control of torpedoes. Military authorities spent a large amount of time in furthering the idea until last Summer, when the chief of the coast artillery, owing to the developments of bombing from aeroplanes, decided to recommend its abandonment.

It is stated that, because of the new device, the Navy has asked the Senate subcommittee considering the Army appropriation bill to strike out the requirement that the \$750,000 appropriation made in 1916 to acquire the special rights of John Hays Hammond, Jr., be returned to the Treasury.

Radio Needs No Aerials

Chicago.—A new type of radio receiving device, without aerial electrical power line connection or any existing apparatus except several yards of wire tacked on the back of the cabinet which contains the set, was announced May 18 by B. F. Miessner, radio engineer.

Adequate reception of signals is accomplished by a superamplifier, which, according to Mr. Miessner, magnifies the signal about fifty times more than the ordinary three-tube amplifier, rendering it fully as audible as signals received with aerial antennae.

The receiving set is simplified, having only a button to turn on the power, generated in small storage batteries, also in the cabinet, and a dial on which the wave-

lengths are marked. After adjusting the dial to the wavelength on which the operator wishes to receive, no other adjustments are necessary.

Predictions of Static Pest Exaggerated

For the last two months the pessimist has been stalking abroad in the land of radio, preaching disaster by the mighty hand of static. In fact, his constant preachments have wrought the average radio fan into a state of bewildered frenzy and terror over the anticipated results of the terrible bugbear.

"Wait until you get the Summer static," declares the radio pessimist, with a sardonic grin and a significant nod, "and then you will see how undeveloped radio really is. Wait until you get a discordant jargon of sounds right in the midst of your favorite selection and you will be ready to throw your collection of junk out of the window in despair—unless you are incapacitated through sheer madness before you can do it."

Now, this sounds very terrible—and, till the rest of you, I have been listening to on every hand for the past seven or eight weeks. Let us, therefore, reason this thing out and see where we get off. In the first place, we haven't suffered any material damage so far from static, have we? To the present, therefore, we have experienced nothing to get alarmed about.

Let us go still further and take experience as our guide. Most of the pessimists are basing their predictions on assumption and what they have heard. Most of the live in the vicinity of cities where broadcasting stations have only been in operation for a few months at most. They forget that in Pittsburgh a regular broadcasting station has been in active daily operation for more than a year. Static has not put the receivers in the neighborhood of the steel metropolis out of business. Far from it; the residents of the Smoky City are more enthusiastic than ever over radio after more than twelve months' experience with it.

Broadcasting is no new thing. The only new thing is the general public interest in it. Ever since the development of the radio telephone to a point of good performance there has been broadcasting of one sort or another, but, of course, it did not get upon an organized basis until the big commercial stations were operating.

Before that time the amateurs were engaged spasmodically in broadcasting to other amateurs, and they did it mightily well. Static did not seriously inconvenience them.

Having said this much, it would not be a bad idea now to explain something about static and its characteristics. In the first place, stated roughly, static is lightning in the making. It consists of accumulated charges of electricity which are stored in the atmosphere, not large enough in capacity to break down the air resistance and find a path to the earth.

They are stored up just like charges on the plates of a condenser, and, like the latter, some of the charge leaks across the dielectric—or air. In the case of static this leakage takes place along the aerials of radio stations wherever they are erected, and the passage of the charge is recorded

the telephone receivers. These static charges are so broad and cover so many different wave lengths that they penetrate most all tuning adjustments.

The peculiar thing about static is that it is most prevalent in tropical countries. In northern latitudes it is most prevalent in summer, and always worse after dark than during the daytime. Its effect upon the telephones ranges in tone from harsh, rasping sounds to mushy squeaks, and when it is really bad it is continued throughout the night without any let-up.

Such are the general conditions of static. For the purpose of wireless telegraphy static offers a very serious problem, because of the constancy of the sounds which produce the dots and dashes, and also because of the fact that the static gets in between the dots and dashes, making it almost impossible to distinguish them.

So far as radio telephony is concerned, however, I do not think that static will be nearly so serious. In the first place, telephony by means of radio is only possible by means of continuous waves, and where continuous waves are used in the ether we get extremely sharp tuning, which itself is quite helpful.

Secondly, we are dealing with voice and music sounds, and these vary in pitch and amplitude, so that the hearer does not have to concentrate on one pitch and pick up dots or dashes. I fully believe that with careful tuning the voices and music will be clear above the static, but of course careful tuning will have to be used—and at will come with experience.

In this connection there are some useful hints that it would be well to observe when static does come in badly. In cases where static is absolutely at its worst I would advise the radio fan who is using two types of radio-frequency amplification temporarily to give up the luxury of a loud speaker and be content to wear the telephone head receiver on those particular nights.

The reason for this is that the amplifiers amplify every current that is passed through them; and the static, being of more volume, is amplified more than the music and speech. The result is that music will be clearer on the detector alone than it is on the amplifier.

Another tip is to reduce the amount of current passed through the filaments of the vacuum tubes to the lowest possible amount consistent with results. This will tend to reduce the effects of static, because the more current passed through the tubes the more the static is increased in intensity as compared to the music.

Above all, adjust your tuning handles very carefully and very slowly and you will find that static is not nearly so bad as it is painted by the pessimists.—*Jack Binns*
N. Y. Tribune.

Navy Radio Works 6,000 Miles

The Navy radio from Cavite, Philippine Islands, to San Francisco, a distance of 6,000 miles, is believed to be the longest in the world. Every day 2,000 words are dispatched from the Navy super station. Though greater distances have been attained under favorable conditions, the Navy station has been operating regularly, without interruption, for more than a year. The Cavite aerials are supported by three 80-foot towers and the station power is 50 kilowatts.

Sweden to Talk Here Direct

An agreement with the Radio Corporation of America and the Swedish State Telegraph Board will bring about the erection of a large station in Sweden with an

easy trans-Atlantic range. Sweden's wireless communications now are dispatched from the great station at Stavanger, Norway. Work on the new station will be begun at once.

Radio and Automatic Gun to Fight Auto Bandits

If banditry is to be made so dangerous that none but a fool would attempt it, there are three prime modern elements that must be applied, General John T. Thompson, director of arsenals for the United States Army during the war, said in an interview last week.

The first is mobility as great as that of the bandit using a high-powered car; the second is the most deadly rapid-fire gun obtainable, and the third is the broadcasting method of radio telephony, so that flying squadrons of motorcycle policemen may be informed at once of the route of fleeing bandits.

General Thompson is the inventor of over a hundred various methods of firearms and of the new anti-auto-bandit gun.

"The answer to modern banditry," he said, "is the speed, the portable rapid-fire gun and the radio-telephone. For instance: A group of bandits descend on a bank, rob it, kill a man or two perhaps, and then leap into their auto and are gone. Where? No one knows. Meanwhile a central radio station broadcasts the news to all the motorcycle squadrons, who, in addition to the auto-bandit gun, will have a radio receiving set with them. Every policeman within a hundred miles is immediately on the watch for the car.

"The auto, they see, has no intention of stopping, and is tearing down on them at ninety miles an hour. There's the deadly weapon and there's the use for it. The policeman in the side car presses the trigger and the bullets begin to stream into the auto. The tires are cut to ribbons, the body is knocked into flinders, the tanks are made sieves. Either the car blows up in the road or it lands against a tree and the bandits are carried off on doors. The policeman cleans his guns and reports back that the bandits have been stopped. After a happening like that the moral effect on the bandits is to make them so careful that they stay indoors.

"The rapid-fire gun and the radio not only make it almost impossible for criminals to escape, but scare others so heartily that they'll clear out of a city where these appliances are in force."

Wired Wireless Demonstrated

The system of broadcasting entertainment along electric light wires, invented by Major General George O. Squier, chief signal officer of the United States Army, was demonstrated for the first time in New York last week. The demonstration was made in the National Arts Club, 15 Gramercy Park, under the supervision of Lieut. Colonel C. A. Sloane, chief executive to General Squier, and was witnessed by a large number of guests.

Before playing each of the artists was introduced to the audience, after which they went to the transmitting station in another building, where a studio had been specially arranged for them. The building chosen for this purpose was on the same electric light circuit as the club house where the demonstration was held.

A feature of the event was the use of the same electric light socket to which the radio receiving apparatus was attached, for the purpose of heating an electric iron, operating an electric fan and lighting an electric light. This was done to emphasize the fact that the radio carrier currents

which travel over the electric light wires are not interfered with in any manner by the ordinary power current carried by the line.

Before the demonstration Colonel Sloane delivered an address on world communication, in which he outlined the development of wireless in all its phases, and concluded by describing General Squier's system of "Wired Wireless."

"Only one hundred of a trillionth part of the energy used by the transmitting station is received in the present broadcasting method," he said, "while in the method used by General Squier only one-half of 1 per cent of the present energy used in sending is necessary.

"The advantages of using the light circuit instead of antennae in crowded cities, where the air is jammed with messages, is incalculable; and there is the added safety from lightning.

"At present the general's method is such that the sound produced must be made for the light circuit; but we hope soon to have a practical method for using the light circuit to pick things out of the ether."

The demonstration was presided over by Commander William Seaman Bainbridge, N. S. N. R. F., who explained that it would now be possible for every school and factory in a city to listen in to a band concert, for instance, played on the Mall in Central Park.

B. Sherman Fowler, a composer, was one of the artists introduced to the audience, who afterwards played some original compositions over the "wired wireless." Colonel Sloane was assisted by officers from Governor's Island. Motion pictures of the modern methods of communication used by the United States Signal Corps were shown.

The only drawback in the demonstration was due to the fact that the club has its own electric generating plant, which was not as steady in its operation as the big commercial plants, but this did not mar the tests.

Book Reviews

"The A B C of Vacuum Tubes in Radio Reception," by E. H. Lewis, is a book that will be appreciated by the experimenter in the radio game who desires a deeper knowledge of the principles that underlie that most wonderful and important instrument—the vacuum tube. Besides explaining in a clear manner the workings of the vacuum tube, the book treats on the principles that underlie all radio reception, and contains some practical hook-ups and suggestions that are very valuable. This volume may be obtained from the Norman W. Henley Publishing Company, 2 West Forty-fifth street, New York City, for a dollar.

Another book just released by the same publisher is "How to Make Commercial Type Radio Apparatus," by M. B. Sleeper. This book describes in detail many commercial types of spark and vacuum tube transmitting sets, and receiving sets of most modern and efficient design. The experimenter will be able to get a world of ideas for the design and construction of his next piece of radio apparatus from the clear descriptions and the clearly illustrated figures.

"Radio Receiving for Beginners," by Rhey T. Snodgrass and Victor F. Camp is a book that covers all that its name implies. It is short and to the point. It is valuable to the beginner, not only for what it contains but for what is left out. It is a good book for anyone who does not care to wade through a swamp of theory and useless information. The Macmillan Company is the publisher.

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AERIAL AGE

WEEKLY

Vol. 15, No. 13

JUNE 5, 1922

10 CENTS A COPY

Including Radio Section



Section of Chicago, Showing the Wrigley Building in the Center. Photograph by Whitney Spear & Co.

The Flight Around the World—Commercial Aviation Development in the United States



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GOODYEAR

June 5, 1922



Vol. XV, No. 13

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B. C. BOULTON
Contributing Technical
Editor

G. F. McLAUGHLIN
Contributing Technical
Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

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VOL. XV

NEW YORK, JUNE 5, 1922

No. 13

The Flight Around the World

MAJOR Wilfred Blake and Capt. Norman Macmillan set forth on their historic around-the-world flight on May 24. The Aircraft Disposal Company has, with commendable sporting spirit, placed four machines at their disposal, and the project appears to give fair promise of success. The machines to be used, although not of new types, have stood the test of time, and, given reasonable luck, the aviators should have a very good chance of getting through. Although as a sporting effort the use of a single machine for the entire flight would have been more spectacular, the employment of four machines, of three different types, will be a much closer representation of the actual conditions which will obtain when we come to run really long-distance services, and from that point of view is, perhaps, of even greater practical value.

Two of the machines will be DH9's (three-seaters) with Siddeley "Puma" engines. One will be a Fairey twin-float seaplane of the famous F. III type, which has a Rolls-Royce "eagle" engine, and the fourth will be a flying boat of the F. IV type.

In the main, the route to be followed by Major Blake and Captain Macmillan will be the same as that planned by Sir Ross Smith. The last "leg," however, will be different from that planned by Sir Ross Smith, who, it will be remembered, had intended to make the Atlantic crossing direct from Newfoundland to Ireland if possible, or, as an alternative, fly from Newfoundland to London via the Azores and Portugal. Major Blake and Captain Macmillan intend to follow the northern route via Greenland, Iceland, the Faroe Islands and Scotland, which will considerably shorten the non-stop stages that have to be negotiated. At the time of year when it is expected to cover this part of the flight the weather in the northern latitudes should be favorable, except for local fogs, and by taking this route the strain on the engines should be considerably reduced.

The manner in which it is intended to use the various machines is as follows: One of the DH9's will be used for the journey from London to Calcutta. Here the aviators will change over to the Fairey F. III seaplane, which will take them around the coast up to Kamchatka and across to Alaska. Here another DH9 will await them, on which the flight across Canada and America to New York will be accomplished. From New York

or Newfoundland the last stage, across the northern part of the Atlantic, will be attempted in the F. boat.

This, in very brief outline, is the plan of Major Blake and Captain Macmillan, and, barring unforeseen accidents, the scheme promises success. That difficulties will be met and obstacles have to be overcome goes without saying, but there is certainly a very good chance of getting through. All the machines to be used, although of fairly old type, have been proved by years of flying under all sorts of conditions, and should be capable of the stages on which each is being used. The engines also have proved themselves in numerous long-distance flights, and may be expected to uphold the reputation already established. Captain Macmillan is one of our best pilots, and has had experience of a number of different types of machines.

Altogether, the scheme looks promising, and we wish the gallant aviators every success in their very sporting attempt.

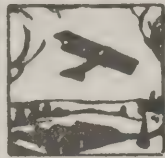
Dine in London—Sup in Paris

THE night flying route between London and Paris was recently inaugurated by Major-General Sir W. S. Brancker, Director of the Air Ministry, and Lieut.-Col. Lyster F. Blandy, in charge of communications for the Ministry. The new service, using Handley Page machines, will be known as the Starlight Airway Route, and promises to be another historic step in the progress of aviation.

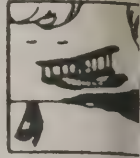
When the route is regularly operated, which will be soon, it will be possible for a party to dine in the West End of London and get a midnight supper on the hill of Montmartre in Paris. It will follow the regular continental air path and signal lights will be aglow at all the airdromes along the line.

Discussing its possibilities, Col. Blandy said: "Night flying from London to Paris is sure to come as an established service because its advantages over the present means of transport by rail and sea are obvious.

"By this means we hope in every way to develop trade, and we believe that passengers will come to regard the starlight route as the ordinary way of getting there. Certainly it will be the quickest and the pleasantest; and, if not the safest, it will at least be equally safe as any other way. It should appeal strongly to business men who cannot afford to waste a day or a night with its inconveniences of traveling. We are demonstrating to the public the extraordinary possibilities of night flying."



THE NEWS OF THE WEEK



Propose Air Freight New York to Chicago

The War Department is asking information as to the probable volume of traffic available for the support of an air line for commercial transportation between New York and Chicago. The Government desires to promote the commercial use of aeroplanes so that the development of aeronautics in this country may keep pace with the advance in other countries. Congress is now considering two phases of the subject—air mail service and commercial transportation by aeroplanes.

Major General Mason M. Patrick, Chief of Air Service, in a letter to William Fellowes Morgan, President of the Merchants Association, requests that the association aid in obtaining information sought in the proposed extension of air lines with Government co-operation.

"In accordance with the announced policy of the President and of the Secretary of War to encourage the early development of civil aeronautics," says the letter, "this office has under investigation the possibilities of civil aircraft operating as a transportation agent along organized routes. In particular, an organization to permit daily overnight transportation between the industrial communities of New York and Chicago is being considered.

"It is of first importance to determine as accurately as possible what the average daily volume of traffic would be which would utilize overnight air transportation if it were so established that the reliability and safety of service were comparable to present-day railroad standard. Merchandise and express will probably be collected in the downtown districts of New York and Chicago between 6 and 7 P. M., with delivery the following morning in the opposite city between 7 and 8 o'clock. It will be necessary to charge probably between \$1 and \$2 a pound, at least during the development period. To assure absolute reliability will require a very thorough organization of ground, navigational beacons and landing fields, for which it may be possible to gain generous Government support, if it can be demonstrated that the service contemplated will fill a sufficiently important business demand.

"Your association is in a position to render a valuable service to this office if you will undertake to determine what the probable volume of business will be which will patronize an air transportation service such as outlined at the rates suggested. It is the desire of the Government to encourage these activities in civil aeronautics which will most directly bring about the creation of a self-supporting aeronautical industry and the co-operation of your association to that end will be appreciated."

The association, in commending the request to the consideration of its members, asks a statement from them of their views as to the utility of the proposed service, together with an estimate of the quantity of traffic which each one probably will be able to supply to the support of the line. The data will be transmitted to the War Department in accordance with the request of Major General Patrick. While it may not be possible, the association adds, for every member to estimate accurately the extent of the traffic which he could supply, it is nevertheless probable that many

merchants could make an approximate estimate of the extent to which they could use the proposed transportation agency, and urges that this be done.

Fokker in America

A. H. G. Fokker, Dutch aeroplane manufacturer, reached port May 28 on the Holland America liner Nieuw Amsterdam, bringing with him two new planes which will be used in this country.

Mr. Fokker said that it would soon be as safe or safer to travel in aeroplanes than in street cars. Every one in Europe now is using planes as they use automobiles, and the companies operating aeroplanes have had to establish waiting lists.

The inventor is here for a visit of two months to look into the use of his planes in this country.

Greater Safety for Air Travellers

Pending the enactment of legislation for the regulation of air navigation the National Advisory Committee for Aeronautics in a resolution adopted recently calls upon the operators of aircraft to voluntarily equip their aircraft to promote the safety and comfort of passengers. It is the Committee's opinion that the suffering and loss of life attending forced landings of aircraft on land or water can in all probability be lessened by making use of existing knowledge and facilities. To this end the Committee urges "that large seaplanes should be provided with wireless and other signaling equipment, be seaworthy as well as airworthy, and carry at all times fire extinguishers, life preservers, a first-aid kit, and a supply of food and fresh water; that aeroplanes operating over the land should carry wireless or other signaling apparatus, fire extinguishers, and a first-aid kit." It is understood that the accident to "Miss Miami" in which four persons lost their lives, for want of reasonable precautions to provide for the safety of air travellers, prompted this action by the National Advisory Committee for Aeronautics. Legislation for the regulation of air navigation is now pending in Congress. A bill introduced by Senator Wadsworth to create a Bureau of Civil Aeronautics in the Department of Commerce has already passed the Senate.

Round the World Flight Starts

LONDON—Major W. T. Blake, Captain Norman MacMillan and Lieut. Col. Broome started May 24 from the Croydon aerodrome in an attempt to fly around the world. They are using a DH19 aeroplane, and hope to complete the journey in about ninety days, reaching Croydon on Sept. 7. Their route as planned is 30,000 miles long.

Major Gen. Sir William Brancker, Director General of Civil Aviation, attended to wish them good luck, and a message from the King and Queen was handed to Major Blake as he stepped aboard the aeroplane: "Their Majesties wish you all godspeed and good luck."

Major Blake's wife and little daughter Barbara, as well as his father and mother, came to see the starting. His wife handed him a black cat mascot as she kissed him good-bye.

Enthusiastic cheers were raised by a large crowd of well-wishers as the aeroplane left the ground.

Navy Launches Fighting Planes With Passengers From Ship Deck

The Navy Department announced a successful experiment of launching service type of seaplanes from the decks of vessels by use of the catapult. The planes are powerful enough for both observation and fighting purposes.

The experiment was made from the deck of the battleship Maryland, the country's most powerful sea fighter, at Yorktown, Va., on May 24.

This is the first time it has been possible to launch an effective plane carrying passengers and well weighted. Heretofore the experiments have been with small, unserviceable planes without loads.

The success of the experiment is regarded by navy officials as the means of meeting the menace to battleship by attack from the air and is the defensive reply to the air offensive demonstrated in recent bombing experiments of the army and navy.

It is interpreted by the experts as meaning that the battleship remains the fighting unit of the navy, which aims to equip every battleship with the mechanism necessary for launching a fighting airship while at sea.

The project of catapulting planes from a ship was effected first in 1915 on board the North Carolina, followed in 1916 by further experiments on the Huntington.

Flight of 1,000 Miles at 110 Miles an Hour

Washington.—Major Roy C. Geiger of the Marine Corps is believed to have broken the record for time and long-distance North and South flying May 27 between Quantico, Virginia and Pensacola, Florida, in a D. H. D-4 Marine Corps aeroplane with a Liberty motor.

Major Geiger left Quantico, thirty miles south of Washington, at 4:40 A. M. and arrived at Pensacola at 3:30 in the afternoon. This time included approximately two hours of stop-over, making the actual flying time less than nine hours. The flight was made at an average speed of about 110 miles an hour over a distance estimated at 1,000 miles.

Two stops were made, the first at the Army Aviation Field at Fayetteville, N. C., for an hour and a half. During this time the plane and motor were inspected and oil, gas and water obtained. The second stop was at Americus, Georgia, for a half an hour while the tanks of the machine were being recharged with gas. Major Geiger carried Sergeant John Belcher with him on the trip and about fifty pounds of baggage.

Experts at Marine Corps aviation headquarters said that Major Geiger's time was undoubtedly the fastest ever accomplished between Quantico and Pensacola, with the country to be covered is broken and difficult to negotiate. They said the speed for the journey was phenomenal and believe that Major Geiger may have broken the world's record for speed over that distance.

The AIRCRAFT TRADE REVIEW

Huff Daland Aeroplanes at McCook Field

A great deal of interest has been aroused at McCook Field in the two types of Huff, Daland and Company's thick wing biplanes now under test by the Engineering Section of the Air Service.

This company has been specializing in the manufacture of very simply constructed aircraft which use the Gottingen 387 thick wing and are remarkable for the liberal use of plywood and steel tubing in their structure. At present there are two types of planes at McCook.

The first type, which has already been flown and is now undergoing its official performance tests, is the OX5 motored two or three place, officially known as the HD8A, which this company is marketing under the trade name of PETREL. This plane is a development of the Anzani motored machine with the same wings which was flown by Lieutenant Harris last Fall. Its makers claim a top speed of ninety-three miles per hour and a landing speed of less than thirty five with a total useful load of seven hundred and thirty six pounds. Inasmuch as the entire surface of the plane is less than two hundred at thirty square feet, this performance is considered very remarkable.

The PETREL has been very thoroughly tested as regards its structure. Its radiator has been flow tested. Its propeller has undergone an endurance test at 1800 RPM. Its struts have been pulled in an Olsen machine, and aside from a few minor changes, the plane has been approved as manufactured. This plane is now undergoing its performance tests, and figures will be issued shortly. Up to the present no attempt has been made to check the figures which resulted from the manufacturer's tests at Ogdensburg, but Captain McCready reports that the PETREL as flown last week is very easy to control, which is one of the manufacturer's chief claims.

The second type of plane which this company is manufacturing for the Air Service specifications, is a smaller version of the PETREL, with 176 square feet of surface and the 140 HP Model R nine cylinder Lawrence motor. The plane has the Gottingen wing, but unlike the PETREL its wing is tapered upward in thickness and forward from the center of the trailing edge in chord for greater speed. The ship is designed as a pursuit aiming plane and is claimed to have all the flying characteristics of a single seater machine, together with a low landing speed and high safety factor. In appearance it shows much thought in its perfect stream-lining, large angle of attack when landing, and general clean appearance. In regard to surface and loading it is similar to the fifteen square meter Neuport which was considered the most maneuverable aeroplane of its class by pilot's who went through the French pursuit schools overseas. However, it should be remembered that this plane is powered with 140 P.

Huff Daland and Company claim for their Lawrence plane a high speed in ex-

cess of 120 MPH. in addition to its maneuverability and low landing speed, so that the official tests on this two seater will be of utmost interest.

The results of the performance tests on both these planes will be published in these columns as soon as such publication is authorized.

Curtiss Oriole for Capt. Roald Amundsen's North Pole Expedition

ONE of the most important pieces of equipment which left Seattle with Capt. Roald Amundsen's North Pole expedition on the three-masted schooner "Maud" is a stock Curtiss "Oriole" with a Curtiss C-6, 160 h.p. motor, equipped with electric starter. This plane was presented to Capt. Amundsen by the Curtiss Aeroplane and Motor Corporation and christened at the Curtiss Flying Field, Garden City, L. I., on April 6, 1922, and now bears the name "Kristine." The fact that Capt. Amundsen has equipped his expedition with a modern aeroplane shows that he appreciates the advantages to be gained by this means of transportation. It is his plan to drift across the Polar Basin in the vicinity of the North Pole with the Schooner "Maud" and during the passage make exploring and mapping trips in all directions radiating from the supply ship, using the ship as a base. By doing this it will be possible to cover a vastly greater area of country and to secure photographs from which can be produced an accurate map of the country giving both the geography of the territory and the general condition of the terrain.

Capt. Amundsen has secured as his pilot Lt. Oskar Omdal, formerly of the Norwegian Navy. Lt. Omdal has selected a specially qualified crew to keep the plane in condition to operate under the severe weather conditions which they expect to encounter. The "Oriole" has been equipped with snow skids which are interchangeable with the landing wheels and tail skid. Additional gasoline tanks have been installed making the total fuel capacity ninety-four gallons of gasoline, or sufficient fuel at cruising speed to cover a distance of six hundred and forty miles. An aeroplane to operate

under the varying weather conditions which will be met on this expedition must be equipped with special devices for regulating the temperature of the motor, of the cooling water and of the lubricating oil, and in this case the Curtiss company have gone a step further and equipped this plane with a Reed duralumin propeller to withstand varying temperatures and moisture conditions and in case of a bad landing it may be possible to salvage a propeller of this kind, where with a wooden propeller the crew would be hopelessly stranded. A detailed summary of the "Oriole" is as follows:

Weight of machine empty (with wheels)	1788 lbs.	(with skids)	1845 lbs.
Oil, 5 gal.	37 "		
Gasoline, 94 gal.	564 "		
Water, 6.6 gal.	55 "		
Pilot	160 "		
Passenger	166 "		

Weight with full load	2770 lbs.
Loading: Area	399.7 sq. ft.
Lbs. per sq. ft.	6.93
Lbs. per h.p.	17.29

High Speed	96 m.p.h.
Low Speed	45 m.p.h.

One of the objects in the presentation by the Curtiss Aeroplane and Motor Corporation of this ship to Capt. Amundsen was the desire to learn something of the operation of the C-6 in the "Oriole" under the severe atmospheric conditions which will be encountered in the Arctic, and further desire to have the Reed metal propeller, which was invented by Mr. S. A. Reed, and of which a number have been built under his direction at the Curtiss factory, tried out under the atmospheric conditions which a metal propeller is supposed to be particularly adapted to withstand. Capt. Amundsen is keeping the Curtiss Aeroplane and Motor Corporation fully advised of the operation of this ship and motor, and is planning if possible to return the ship and motor to the Curtiss Company at the end of his expedition with a full report of the details of their operation.

DOMESTIC EXPORTS OF AIRCRAFT AND AIRCRAFT ENGINES, FROM THE UNITED STATES, BY COUNTRIES, DURING MARCH 1922.

Countries	Airplanes and Seaplanes Number Dollars	Other Aircraft Number Dollars	Parts of, Except Engines and Tires Pounds Dollars	Internal Combustion Aircraft Engines Number Dollars
France	— —	— —	— —	22 6,500
England	— —	— —	214 70	— —
Canada—Mar. Prov.	— —	— —	— —	1 17
Quebec & Ont.	— —	— —	1,093 2,230	— —
Prairie Prov.	— —	— —	97 57	— —
Br. Col. & Yukon	— —	— —	198 169	— —
Mexico	23 19,850	— —	1,137 270	— —
Argentina	— —	— —	112 291	— —
Straits Settlements	— —	— —	444 100	— —
New Zealand	— —	— —	100 43	— —
Total	23 19,850	— —	3,395 3,230	23 6,517

The above figures were compiled by the Department of Commerce.

COMMERCIAL AVIATION DEVELOPMENT IN THE UNITED STATES

By W. KNIGHT, M. E.

IN A SERIES of articles published in the AERIAL AGE of March 20th and 27th, and April 10th and 17th, 1922, I have summarized the developments of commercial aviation in Europe up to the end of 1921 and I have tried to show that, in spite of the fact that some very decided progress has been made in the organization of aerial transports in Europe in the last three years, they are far as yet from being a success, both from the point of view of the public and the investor in aerial securities.

In every country in Europe commercial aviation activities were born under the regime of a paternalistic government protectorate and have been able to survive and to further expand (in spite of the fact that every one of them represents a dead loss of money), due to the substantial subsidies which have been most generously lavished upon them by the various governments. The French government has contributed more than any other government in Europe to the development of both its military and commercial aeronautical activities, and France is today in a position to claim the supremacy of the air in Europe.

After almost three years of operation and expansion of aerial transports in France and elsewhere under these conditions, a point has now been reached when the people in Europe, and especially in France, begin to wonder what is the matter with commercial aviation which after three years of operation under the regime of government subsidies is unable to earn as yet one-quarter of its operating expenses.

Government subsidies and government control offer some advantages but they also offer a good many disadvantages. Government control of business activities and government subsidies intended to make good the losses incurred in the development of a new national industry and in opening up new international commercial lines of communication are very desirable in some cases as an emergency measure, but in the end they are bound to be detrimental to the development of any commercial enterprise on a healthy business basis if the practice of substituting governmental paternalism to unhampered business initiative is not stopped in time.

Government officials in every country, by necessity of their training in the government service whose business is to raise and to spend the money contributed by taxpayers, are not always particularly competent when it comes to the point of making money out of a business controlled by the government. The history of the business adventures of the government of the United States during the war and after the war is a recent instance that we all know of.

The injection of politics, government control and subsidies into any business activity for any extended period of time is bound to destroy business efficiency in the end and this is what both the people and the governments in Europe are beginning to realize, in so far as commercial aeronautical developments are concerned.

In the United States we have not had up to the present time any government intervention under the form of subsidies for establishing aerial commercial lines in this country, in spite of the fact that the Air Mail Service established and run by the Post Office Department of the U. S. Government stands so far as the biggest and the best organized undertaking of commercial aviation in the world. It is most likely that we shall never have any subsidies paid to our aerial transportation company under the same form as they are paid in Europe, except for whatever service they might be able to perform for the government—as, for instance, for transporting mail at a certain rate per ton-mile with a guaranty of a minimum load for each trip.

The idea of paying subsidies to aerial transport companies as an inducement to them for starting and developing commercial aviation in the United States and to reimburse the losses incurred by them in the operation of aerial lines is undemocratic and against the fundamental American business canons. If the people in this country want this kind of service they can have it, but it is up to them to organize aerial transport companies and to run them as any other business activity with as little interference on the part of the government as is possible and desirable in an undertaking of this nature, which is bound to have a tremendously important bearing on our national defence and on the development of our foreign trade.

Due to the lack of government subsidies and to the fact that right after the war the aircraft manufacturing industry both in this country and abroad had not developed as yet a type of motor and airplane well adapted to commercial exploitation,

our business men have been slow in starting any commercial aviation activities in this country. During the last two years, however, some very decided progress has been made by the aircraft manufacturing industry both in Europe and in the United States. Better motors and better airplanes have made their appearance. Metallic airplanes (which are the logical aerial carriers of the future) have been developed, and the airplane has ceased to be a war engine and is now well on the road to become a means of transportation as safe, practical and economical, under reasonable limitations, as any other,—and a good deal more rapid and flexible than any other present means of transportation.

During the last two years, however, in spite of the lack of government subsidies and in spite of the lack of regular operating aerial lines and of clearly defined national policy and program in aeronautics in this country, almost 31,000,000 miles were flown by both military and civilian aircraft, and 500,000 passengers were carried by civilian airplanes in addition to many tons of freight.

The failure of Congress to enact a much needed aerial legislation making possible easier credits and more satisfactory insurance rates has been greatly responsible for retarding so far the establishment of regular commercial aerial lines in the United States, which is better adapted than any other country in Europe (with the exception of Russia, possibly) to this new means of transportation of freight and passengers. The action of some incompetent self-styled business men, with no knowledge at all of commercial aviation problems, in starting an aerial transport corporation with great plans for tying together all the most important commercial centers in the United States and finally failing in the most inglorious way for lack of elementary business sense and common honesty, has also contributed in discouraging people here from investing the money in aerial securities.

The failure of aircraft manufacturers, who are more interested than anybody else in the establishment and development of aerial transportation companies in America, in taking the initiative in opening up and keeping in operation one or two regular aerial lines, just as aircraft manufacturers in Europe did right after the war and are still doing at the present time has not contributed a bit in inspiring confidence in the public in a means of transportation in which apparently aircraft manufacturers had not enough confidence to invest their money in, all the time, however, keeping the prices of their products sufficiently high to pay for the expense of their partially inactive manufacturing establishments and putting up a legal fight for preventing the dumping into this country of cheap foreign aircrafts.

The lack of proper financial support that our Aero-Club, the Aeronautical Chamber of Commerce and similar organizations are receiving from the public, the government and aircraft manufacturers is another contributing cause of our slow progress in commercial aviation developments. This, in spite of the fact that both the Aero-Club and the Aeronautical Chamber of Commerce are two organizations which by working together harmoniously and intelligently can render valuable service to our aircraft manufacturing industry and can greatly contribute in eliciting the interest of the public both in this country and abroad in our aeronautical activities. This fact is well recognized in France, where the Aero-Club is one of the best organized in Europe, is a force to be reckoned with in an aeronautical event taking place on the European continent and is doing a splendid work for contributing to the development of commercial aviation in the world and for protecting and advertising all over the world French aeronautical interests.

In spite, however, of all limitations and handicaps; in spite of the lack of a much needed legislation on aeronautics; in spite of crooks who have tried to use aeronautics as a swindling proposition; the advent of commercial aviation in the United States is coming, is coming fast and once we get started there will be nothing to stop us, and inside of a few years we shall probably lead the world in commercial aviation development.

We are far behind Europe at the present time because we did not believe, and we do not believe, in government subsidies and government control of aerial operating companies. We believe, however, that the government, in cooperation with business and technical men and organizations interested in aeronautics, must provide us with aeronautical laws and regulations.

ns, landing fields, meteorological and wireless services, just European governments are doing. We believe that the government must protect and encourage by any means the development of our aircraft manufacturing industry but, at the same time, aerial operating companies, if they are not expected to operate aerial lines at a loss, especially during the first year or two of operation, cannot be required to buy aircrafts in America if American aircraft manufacturers cannot supply as good aeroplanes as are obtainable in Europe, at such price as to make it possible for the operating companies to consider the patriotic end of the transaction when they must decide whether to buy their equipment in the United States or in Europe.

To be patriotic about the development of a national aircraft manufacturing industry is all right, of course, but aircraft manufacturers in this country, who have made very substantial profits during the war, must keep in mind that patriotic considerations and business considerations cannot always prevail at the same time unless they are well balanced together. We shall be able to buy good commercial aircrafts in the United States for operating our aerial lines, and we shall be able to afford paying more for them than we would pay for equally good aircrafts made in Europe, provided, however, that our aircraft manufacturers are prepared to buy stock in the operating companies and to share with them the risks and the benefits of the operation of our commercial lines during the first years of operation, if it is so desired. If not, I do not see why our aerial operating companies should not go and buy their flying equipment in England, France, Germany or Italy, wherever they can secure the best terms, unless our aircraft manufacturers can meet the competition of foreign manufacturers in the matter of prices and quality, which they cannot do.

We did not want commercial aviation to be born in this country under the regime of government subsidies and government control because the experience that we have had with such things since the late war has brought us to the conclusion that what we want is: more businesslike methods in our government and less (a good deal less) government control over our business enterprises. However, what we want now is that a real constructive work be started without any further delay for putting on the map of the world commercial aviation in the United States, and we want everybody directly interested in this matter to take a share of the responsibilities involved in such an undertaking.

Let Congress take its own share of responsibility and act on the Wadsworth Bill "to create a Bureau of Civil Aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce and for other purposes," and on other legislation affecting civil aviation which has now been under consideration by Congress for quite a long time.

Let the financial groups interested in the development of civil aviation in the United States take a hand in seeing that proper legislation is suggested to and is enacted by Congress at the earliest possible date. Financiers interested in civil aviation developments should also try to discourage at the present time the establishment of a number of small aerial companies. It is much preferable at the present stage of the game to concentrate all efforts into trying to build up and to gradually create one financially strong company, rather than financing many small means a dozen companies. We must keep in mind that the progress of civil aviation at the beginning is to be obtained through cooperation and not through competition, and that the large overhead expenses of small European companies are largely responsible for the deficit of their budgets.

Promoters of aerial companies must remember that the troubles of European companies in Europe are due to three main reasons: First, aeroplanes not well adapted to commercial exploitation; second, imperfect organization of ground services; and third, insufficient commercial loads. Commercial aeroplanes which it is anticipated will be scrapped after 1000 hours' flight or less and motors requiring overhauling after 10 to 200 hours of operation are too heavy a burden on the operating expenses. An imperfect ground organization is responsible for most of the accidents taking place, is responsible to a large extent for the prevailing high insurance rates, and adds considerably to the operating expenses. Aeroplanes traveling always half loaded are not a paying proposition.

The trouble with the aerial lines in Europe so far has been that they have relied too much on the transportation of passengers and that they have not gone strongly enough after the merchandise transportation business. We should start with mail, express matter and freight. After we have succeeded in convincing people that aeroplanes can be operated safely and regularly on scheduled time all year around, when the farmers in the fields shall regulate their watches every day when the 12:15 or the 2:45 aerial express flies above, then we shall know that we can rely on having all the passengers that we want.

The air line between New York and Chicago most likely shall be the first trunk line to be open to traffic, and the operation of this line will spell the success or the postponement of commercial aviation developments in this country. However, we must keep in mind that one trunk line only, even if that be the New York-Chicago, connecting two of the most important commercial centers in the country, cannot attract at the beginning enough traffic to pay for further expansions and that, rather than encouraging the establishment of other companies for operating other trunk lines in connection with the New York-Chicago, we shall have to try to build up and to gradually expand our activities around one main company and make it a strong foundation of our future civil aviation developments thus keeping down overhead expenses and securing a much needed singleness of policy.

Aircraft manufacturers, as I said before, must be prepared to take quite an active interest in the establishment and the development of aerial operating companies and must not look forward to immediate profits while doing business with new operating companies; on the contrary, they must be prepared to help them along with good flying equipment, low prices and long credits if they are interested in getting the business and in defeating the competition of foreign aircraft manufacturers. Commercial aviation is not going to be a booming business for aircraft manufacturers for the first year or two, and they must be prepared to take their share of responsibility in such an undertaking, from which they are bound to gather handsome profits after the aerial operating companies have been successful in operating aeroplanes manufactured by them.

From the Aeronautical Chamber of Commerce, the Aero-Club and all other similar organizations created for the purpose of encouraging the development of commercial aviation in this country and in the world, I think that it is fair to expect fewer programs of future activities and more reports of results obtained. As I mentioned before, however, these organizations cannot be expected to operate without sufficient financial means at their disposal and this financial support must be supplied by the government (city, state and federal), by aircraft manufacturers, aerial operating companies, commercial and financial groups interested in civil aviation developments.

The Aeronautical Chamber of Commerce and the Aero-Club can contribute to the development of commercial aviation in this country and to the expansion of our activities abroad more than any other organization, if we allow them to become the national and international organs of propaganda of our aeronautical activities and the official sponsors of inter-state and national legislation needed in this country for regulating the traffic in the air, and for securing the cooperation of districts and localities in providing properly equipped air harbors and intermediary air lanes under unified federal control.

The extension of the activities abroad of both the Aeronautical Chamber of Commerce and the Aero-Club, in establishing and maintaining a cordial exchange of information and data on commercial aviation developments between aeronautical interests in this country and in Europe and in establishing an effective cooperation between ourselves and Europe in the solution of the international problems which we are bound to face as we develop our activities in the air, is another valuable service which these two organizations can render us.

Three years ago I suggested the extension abroad of the activities of the National Advisory Committee for Aeronautics, for the purpose of establishing an exchange of information and technical data on aeronautics and sciences thereto allied between the U. S. government, on the one hand, and government organizations, technical men, and private concerns in Europe on the other hand. I made this suggestion for the purpose of preserving and further developing the fine spirit of cooperation in the solution of technical problems in aeronautics which prevailed among the allied and associate nations during the war and which was going to be discontinued at the end of the war. My suggestion was taken up by the National Advisory Committee for Aeronautics and I had a chance to realize my project of intellectual international cooperation between ourselves and European government officials of former allied, associated, and former enemy nations, and scientists and technical men in the United States and in Europe interested in technical aeronautical developments. I was appointed Technical Assistant in Europe to the National Advisory Committee for Aeronautics, and from May, 1919, to May, 1921, while acting in the above named capacity, I had the opportunity of creating an effective liaison service between our National Advisory Committee for Aeronautics and technical aeronautical organizations in England, France, Italy, Belgium, Germany, Austria and Holland, whereby our government has been kept fully informed of any progress made in aeronautics as a science and as a branch of engineering. The main and, in my estimation, the most important contribution which has been made by the National Advisory Committee for Aeronautics to the development of aeronautics through the establishment of an office in Europe, has been the promoting of a fine spirit of cordial cooperation between scientists and

technical men interested in scientific and technical research work in aeronautics.

This fine spirit of cooperation which can be brought about only through personal contact and which can be based only on the reciprocity of advantages to be derived from the exchange of most confidential data and information and the interchange of views on the various aspects of problems under consideration, is a very desirable spirit which, by every means, must be promoted and developed between manufacturing, commercial and financial aeronautical interests in this country and in Europe. In other words, the same exchange of information, the same direct contact which has been established and developed by the National Advisory Committee for Aeronautics and scientists and technical men in Europe, should be established and developed between aircraft manufacturers, aerial operating companies and financial groups interested in commercial aviation developments, both in this country and in Europe.

This work cannot be undertaken by the government through the accredited diplomatic or consular channels. Aeronautical attachés, commercial attachés, consular agents and other government officials in foreign service are necessarily limited in their actions, which must be governed by general rules and regulations in order to prevent interference between the various agencies of the government working on the same job; and such rules and regulations as are inspired by general governmental policies are not and cannot always be efficient from a limited and well-defined business point of view and in some cases they work exactly the opposite way.

For instance, my personal experience during the two years that I was the representative in Europe of the National Advisory Committee for Aeronautics was that while I was trying to establish a personal and direct contact between individuals and organizations in Europe and in the United States interested in aeronautical developments (which is the only way to exchange valuable information) I was always interfering with the work of naval and military aeronautical attachés who were trying to obtain information on the same subject through regular diplomatic channels. It is quite obvious that individual and private concerns which are ready to cooperate with other individuals and private concerns in a foreign country, with a view of eventually developing their cooperation into a tangible form of business cooperation, do not care a snap about an impersonal inter-governmental exchange of data and information. Considering the fact that I was obtaining most satisfactory results along the line of cooperation which I had suggested, and that I was securing for the National Advisory Committee for Aeronautics through the establishment of personal contacts more complete data and information than it was possible to obtain through other channels, from a point of view of business efficiency, such a work should have been encouraged and further developed. However, the Committee being as it is a governmental organization, the work of its European office had to be brought in line with the work of other similar agencies of the U. S. government foreign service. This was the only proper thing to do and although I knew that such a step would curtail the efficiency of my office I suggested that the Paris office of the National Advisory Committee for Aeronautics be put under the direct control of the various embassies in Europe, which was eventually done.

I said before that what we need at the present time is more business in the government and less government in our business. This is true of aeronautics as well as of any other branch of activity and applies both to this country and to other countries. In so far as our contacts with aeronautical developments in Europe are concerned, it seems to me that it would be to the advantage of everybody concerned if direct contacts were established on a basis of mutual cooperation in exchanging data and information between aeronautical interests in this country and in Europe, without relying on government organizations to do it for us. Of course, so far, we have not had any commercial aerial operating company in this country, and all it was possible to do was what the government has done for collecting statistical and other data about commercial aviation developments in Europe, which will be of great assistance to us in avoiding making the same errors that were made in Europe during the last three years. Considering, however, that we are on the eve of important developments in civil aviation in the United States, it seems to me that we should take into proper account, right at the beginning, the international aspect of this new means of transportation, and this is bound to have quite a tremendous bearing on its development.

The international aspect of aviation is so wrapped up with its national aspect in Europe that from every quarter, even from those more inclined to follow a strictly national aeronautical policy, the need of agreements and cooperation with foreign operating companies is freely advocated in the aeronautical press by aeronautical interests. The necessity of freeing commercial aviation from the bonds imposed upon it by political considerations under the prevailing regime of government tutelage, brought about by the unbusinesslike method

of paying subsidies to operating companies to make up for losses incurred in the operation of aerial lines, is felt every day more keenly and the necessity of establishing direct contacts with foreign aerial operating companies becomes every day more evident from the point of view of business efficiency.

At the present time we are not much concerned with international civil aviation, as we have enough problems of our own to solve in order to put American aviation on the map of the United States. But on the other hand we all realize that inside of a very few years the Atlantic and Pacific oceans will be crossed quite regularly by airships as well as by steamships and that in a much nearer future we will fly every day to Canada, Mexico, Cuba and South America. And even at the present time when direct shipments can be made right through from Moscow to Havre, or even to Casablanca, I do not see why we should not make arrangements with European aerial operating companies and steamship companies which will allow the making of direct shipments from Moscow to Chicago or San Francisco.

A number of problems are connected with the international side of commercial aviation which are purely business problems and they must be handled through business channels. Contacts between American and European aeronautical interests in a spirit of mutual cooperation in the solution of common problems is what we need to inaugurate right at the outset of our aeronautical activities in the United States. For this reason we must anticipate the organization of an international association of aerial transportation companies and an international aeronautical Chamber of Commerce, the first one grouping together the most important aerial transportation companies in Europe and in America and the second one coordinating the work of the various aeronautical Chambers of Commerce, and clubs and similar organizations throughout the world.

The International Air Traffic Association (I. A. T. A.) organized in 1919 by M. Holt Thomas of the "Aircor," would admirably serve the purpose for which it was created (which is somewhat similar to the one that we are advocating) if the most important aerial operating companies in Europe had taken an active interest in such an organization. As it is at present the I. A. T. A. is only an international organism possessing great potential possibilities of an effective cooperation between aerial operating companies which, however, are not sufficiently made use of or sufficiently extended as they should be, in order to obtain an immediate constructive participation of the most important aerial companies in the membership of the I. A. T. A. or of any other similar international association. In business concerns in matters of common interest, I think it would be a good plan to start a move whereby an exchange of capital stock between these companies might take place. If each of the most important aerial operating companies should become a minority stockholder in all equally important foreign aerial operating companies, cooperation between them and a common participation in the solution of international commercial problems would become part of a policy based on a limited partnership with each other, this being something which is understood by every business concern and a good deal more efficient than the more or less sentimental general resolutions which are usually adopted at the end of each international aeronautical Congress, without being followed by any immediate practical results. Business concerns are not inclined to waste time and money in international debating associations. They are accustomed to dealing with balance sheets and cold facts. The best ties to unite the most important aerial operating companies in the world are those which are established at the meetings of the board of directors of each of them, where the companies are represented as minority stockholders.

For the same reasons, the best cooperation between operating companies and aircraft manufacturers is obtained by having the leading aircraft manufacturers in each country become minority stockholders in national aerial operating companies. In this way, the cooperation between operating and manufacturing interests in each country is based on a business partnership between operating companies and manufacturers, the operating companies, however, always reserving the control of the transportation business. In the same way, while the international cooperation between operating companies, under such a plan, would be based on the same principle of partnership with foreign operating companies, each company would always be free to retain control of its business.

The international association of aerial transportation companies mentioned above should simply be the organ of coordination of the interests of the various companies in its membership and to that body would be assigned the work of making investigations, preparing reports and suggesting actions and agreements in the interest of the various companies, besides being the official international organ sanctioning any agreement between its member companies.

The International Aeronautical Chamber of Commerce was suggested by Mr. E. Pierrot in France, could be

(Continued on page 311)

AIR MAIL SERVICE SCHEDULE

C. F. EGGE, general superintendent of the Air Mail Service, has just issued a memorandum showing the mileage between all air mail stations, the maximum number of pounds which may be transported, the origin and kind of mail carried, and the time advanced over rail dispatch. If the maximum amount of mail is available at each station, the Air Mail advances the delivery of 6,250 pounds or, at forty letters per pound, a total of 250,000 letters daily.

Since July 1, 1921, the percentage of performance has been better than ninety-four, which means that out of each hundred trips scheduled ninety-four were completed.

Air Mail Service Schedule

New York to San Francisco

(Daily except Sundays and Holidays)

Effective May 15, 1922

WEST

Leave New York 6:00 a. m.,	Miles
Arrive Bellefonte 8:55 a. m.	225
Leave Bellefonte 9:15 a. m.,	
Arrive Cleveland by 12 noon.	210
500 pounds. All letter mail for Cleveland accumulated in New York Postal zone under 8:40 p. m., leaving time of New York and Chicago R. P. O. Train 35. Letter mail for Bellefonte accumulated after midnight. Balance load will be Chicago gateway mail. Leave off New York and Chicago R. P. O. Train 9 due to leave New York 5:15 a. m. (due arrive Cleveland 10:50 p. m.) for dispatch to New York and Chicago R. P. O. Train 35 due Cleveland 12:35 p. m. At Bellefonte take on pouch for Cleveland to obtain mail for that office and connections. All Cleveland mail advanced one business day. Air mail arrives before noon; by rail could arrive 5:30 p. m. Train 9 due Chicago 8:00, therefore Chicago gateway mail delivered twenty hours earlier than by rail.)	
Leave Cleveland 8:40 a. m. (E. T.),	Miles
Arrive Bryan 9:40 a. m. (C. T.)	160
Leave Bryan 10:00 a. m.,	
Arrive Chicago by 12:15 p. m.	175
500 pounds. Take Chicago city mail off New York and Chicago R. P. O. Train 19 due to arrive Cleveland 8:00 a. m. Cleveland office will dispatch pouch for Chicago and Bryan. Bryan will dispatch to Chicago. Chicago mail advanced one business day for delivery. Train 19 due to arrive Chicago late for delivery by carrier that day. Chicago mail received at Cleveland has been worked for carrier and station distribution by railway postal clerks in Train 19 between New York and Cleveland. One service between New York and Chicago. Mail leaving New York 5:30 p. m. (delivered by carriers following day in Chicago.)	
Leave Chicago 6:00 a. m.,	Miles
Arrive Iowa City 8:00 a. m.	195
Leave Iowa City 8:20 a. m.,	
Arrive Omaha by 11:30 a. m.	230
400 pounds. 250 pounds Omaha city and balance California and western mail to connect Omaha and Ogden R. P. O. Train 5 at North Platte. (Omaha city mail worked terminal R. P. O. in Chicago for carrier station distribution. Delivery advanced one business day.)	
Leave Omaha 1:00 p. m.,	Miles
Arrive North Platte 4:15 p. m. (C. T.)	245

(Do not hold later than 1:30 p. m. for ship from Chicago, or Omaha train connections.)

500 pounds. Take western mail from Chicago ship, one pouch each for North Platte and Train 5 from Omaha and 300 pounds western mail from C. B. & K. C. Train 27, Minneapolis & Sioux City Train 11-9 and Aberdeen & Sioux City Train 4-104 received at Omaha from Huron & Omaha C. P. Train 209 for dispatch to Train 5 due to leave North Platte 4:32 p. m. (Train 5 is exclusive mail train on fast schedule. All mail handled Omaha to North Platte by air advanced one business day.)

Leave North Platte 7:30 a. m. (M. T.),	Miles
Arrive Cheyenne 10:15 a. m.	215
Leave Cheyenne 10:35 a. m.,	
Arrive Rawlins 12:30 p. m.	134
Leave Rawlins 12:50 p. m.,	
Arrive Rock Springs by 2:15 p. m.	106
500 pounds. Take mail for Cheyenne, Rawlins, Rock Springs, Billings & Denver Trains 31 and 32 via Cheyenne, and Omaha & Ogden Train 3 via Cheyenne, from Omaha & Ogden R. P. O. Train 13 due to arrive North Platte 7:10 a. m. At Cheyenne take on all mail available, which includes Cheyenne pouch for Rock Springs and pouches for Rawlins and Rock Springs from Train 13 received via plane from North Platte. (Train 13 due arrive Cheyenne 3:10 p. m., Rawlins 8:10 p. m. and Rock Springs 12:11 a. m. All mail flown from North Platte advanced one business day.)	
Leave Rock Springs 6:30 a. m.,	Miles
Arrive Salt Lake by 8:15 a. m. (M. T.)	155
400 pounds. Take Salt Lake City letter mail off Omaha & Ogden R. P. O. Train 5 due arrive Rock Springs 4:36 a. m. (Delivery advanced Salt Lake City one business day. Train 5 arrives Salt Lake too late for delivery by carrier that day. Salt Lake City mail received from Train 5 has been worked for carrier and station distribution by postal clerks in Train 5.)	
Leave Salt Lake City 6:30 a. m. (W. T.)	Miles
Arrive Elko 8:45 a. m.	205
Leave Elko 9:00 a. m.,	
Arrive Reno 12 noon.	235
Leave Reno 12:15 p. m.,	
Arrive San Francisco by 2:15 p. m.	190
400 pounds. Take letter mail for Elko, Reno and San Francisco accumulated at Ogden and Salt Lake after departure of Ogden & San Francisco R. P. O. Train 9, leaving 12:55 p. m. Elko will dispatch pouches for Reno and San Francisco. Reno will pouch on San Francisco. (Mail delivered in San Francisco eighteen hours and fifteen minutes earlier than arrival by rail.)	

EAST

Leave San Francisco 2:30 p. m. (W. T.)	Miles
Arrive Reno by 4:30 p. m.	190
400 pounds. Take all eastern mail accumulated at San Francisco after departure of Ogden & San Francisco Train 2, due to leave San Francisco 11:00 a. m.; also pouch for Reno. Dispatch eastern mail to Train 2, which is due to depart Reno 9:30 p. m. (Mail for Chicago and east advanced one business day by overtaking fast Train 2 at Reno.)	
Leave Reno 6:30 a. m. (W. T.),	Miles
Arrive Elko 9:00 a. m.	235
Leave Elko 9:15 a. m.,	

Arrive Salt Lake by 11:30 a. m., (M. T.) 205

400 pounds. Take eastern mail off Ogden & San Francisco Train 20, due to arrive Reno at 4:35 a. m., and dispatch to Omaha & Ogden Train 2, due to leave Salt Lake 12:00 noon. San Francisco dispatch pouch for Salt Lake via Train 20. Reno pouch on Elko and Salt Lake; Elko pouch on Salt Lake. (Train 20 leaves San Francisco 6:00 p. m. and this dispatch connects at Ogden with Train 2, which left San Francisco at 1:00 a. m. previous day. Advance eastern mail one business day.)

Leave Salt Lake 6:45 a. m. (M. T.),	Miles
Arrive Rock Springs 8:35 a. m.	155
Leave Rock Springs 8:55 a. m.,	
Arrive Cheyenne by 11:00 a. m.	240
400 pounds. 150 pounds Salt Lake post office and 250 pounds from S. L. C. & Cal. R. P. O. Train 4, due to arrive 6:00 a. m. Salt Lake office and clerks in Train 4 to pouch on Cheyenne office and on Omaha & Ogden R. P. O. Train 20, due to leave Cheyenne 12:40 p. m. Rock Springs pouch on Cheyenne. (Train 20 leaves Salt Lake at 7:50 p. m. By overtaking this train at Cheyenne eastern mail is advanced one business day.)	
Leave Cheyenne 6:00 a. m. (M. T.),	Miles
Arrive North Platte 8:00 a. m. (M. T.)	215
Leave North Platte 9:20 a. m. (C. T.),	
Arrive Omaha by noon.	245
500 pounds. Take Omaha city mail off Omaha & Ogden Train 6, due to arrive Cheyenne 1:30 a. m. (arrive Omaha 4:50 p. m.), and from Omaha & Ogden Train 2, due Cheyenne 5:25 a. m. (due Omaha 7:15 p. m.). Cheyenne to pouch on Omaha and Chicago & Council Bluffs Train 8. Train 2 dispatch New York State and New England States for Chicago & Council Bluffs Train 8 connection due to leave U. P. Transfer, Iowa, at 6:30 p. m. At North Platte take on pouch from that office to contain Omaha city and connection. (Omaha mail advanced in delivery one business day. The same is true of all eastern mail carried between Cheyenne and Omaha.)	

Leave Omaha 8:00 a. m.,	Miles
Arrive Iowa City 10:30 a. m.	230
Leave Iowa City 10:50 a. m.,	
Arrive Chicago by 1:00 p. m.	195
500 pounds. Take Chicago city mail from Omaha post office and from Omaha & Ogden Train 4, due 7:00 a. m., and from Omaha & Denver R. P. O. Train 6, due 7:00 a. m., and Omaha & Ogden Train 12, due 7:05 a. m. Omaha post office pouch on Iowa City; Iowa City pouch on Chicago. (Trains from which Chicago mails were taken due to arrive Chicago 8:00 to 10:00 p. m. Chicago mails advanced in delivery one business day.)	
Leave Chicago 1:00 p. m. (C. T.),	Miles
Arrive Bryan 3:00 p. m.	175
Leave Bryan 3:20 p. m.,	
Arrive Cleveland by 6:00 p. m. (E. T.)	160
500 pounds. Take New York City mail and mail for points east of Cleveland formerly dispatched to New York and Chicago R. P. O. Train 10 (leaving Chicago 10:30 a. m. and arriving Cleveland 8:30 p. m.) and from Train 26 (leaving Chicago 12:40 p. m. and arriving Cleveland 8:35 p. m.) for dispatch at Cleveland to New York and Chicago R. P. O. Train 4, due to leave	

6:15 p. m. and arrive New York 8:00 a. m. Chicago post office dispatch pouch for Train 4 and for Bryan and Cleveland offices; Bryan to dispatch pouch for Cleveland. (New York City mail dispatched at Cleveland to train arriving in New York in time for bank clearance.)

Miles

Leave Cleveland 6:00 a. m. (E. T.),
Arrive Bellefonte 8:30 a. m. 210
Leave Bellefonte 8:45 a. m.,
Arrive New York by 11:30 a. m. 225
500 pounds. Take New York City letter

mail off Train 22, New York and Chicago R. P. O. (due to leave Chicago 5:30 p. m. and arrive Cleveland at 2:56 a. m.) Cleveland will pouch on New York; Bellefonte will pouch on New York. (Train 22 due to arrive New York 5:25. The New York City mail received from Train 22 at Cleveland is worked for carrier and station distribution by railway postal clerks between Chicago and Cleveland. One day service between Chicago and New York. Mail leaving Chicago at 5:30 p. m. delivered by carriers following day in New York.)

NOTE: The time shown in this schedule for arrival and departure at intermediate stations and arrival at terminals only is for reference. Ships will leave intermediate stations as early as possible after being serviced. The time of departure from initial points will be strictly adhered to in our records of past performance indicating that arriving time at the several terminals will, under ordinary circumstances, be no earlier than that shown on this schedule which has been made on a 70 to 90 mile an hour basis.

NOTES ON PROPELLER DESIGN—IV GENERAL PROCEEDING IN DESIGN

Technical Note National Advisory Committee for Aeronautics

By MAX M. MUNK

Summary

THE choice of the number of revolutions and of the diameter, the distribution of thrust, and the values of the constants in the aerodynamical equations of the propeller are discussed.

The exact design of a propeller must be preceded by approximate computations, leading to the general layout, which in turn must be followed by an analytical examination of the propeller, obtained under several conditions of flight. In the previous notes of this series I have discussed these three steps, including the determination of the distribution of thrust, at length. It will be useful to summarize the procedure briefly in this note and to discuss some general principles in connection with it. For the design of a propeller is a laborious undertaking, and the analysis of the finished design ought to confirm that it is correct. The analysis is not the proper method for studying the effects of different assumptions for the layout. This can be done more shortly and more successfully by a general discussion.

The number of revolutions of the propeller is, in general, determined by the engine; but the problem often remains as to whether reduction gearing is advisable. Now the reduction gear always has a friction loss of 2% at least. What is more serious, it requires a great additional weight of the propeller and gear, it gives rise to increased stresses of the fuselage, and it involves additional complications and possibilities of dead stops. It is expensive, too. These disadvantages cannot exactly be taken into numerical consideration. But it can be safely said, I think, that the reduction gear is inadvisable if the aerodynamical efficiency of the propeller is increased less than 5% by its application. There are designers who prefer even an aerodynamic loss of 10% to a reduction of the number of revolutions by gearing.

The question of the diameter and of the number of revolutions is not exclusively a question of efficiency. There are, of course, upper limits for the velocity of the blade tips. Besides, the design of the propeller is carried out, having in view one particular condition of flight, whereas the propeller is to be used under very variable conditions. It is desirable that (a) the efficiency be fairly high under all conditions and that (b) the absorbed horsepower at the same number of revolutions remain nearly constant. Only if these two requirements are fulfilled at the same time, can the propeller develop the highest thrust horsepower. These two requirements lead now to a limitation of the tip velocity of the propeller blades. For this

tip velocity determines the average velocity of the blade elements and hence the variation of their angles of attack. But it is this angle of attack which has to conform to the variation of the thrust, and hence the variation of the angle of attack determines the lift coefficient. A calculation shows that for constant density of the air the best lift coefficient corresponds to the usual tip velocity, high enough for a favorable ratio CL/C_D . This appears if one applies the aerodynamical equations for the blade element. Hence the designer has to keep in mind that a change in the tip velocity has a noticeable effect either on the behavior of the propeller over a wide range of conditions or on its efficiency, and that this effect cannot be neutralized by minor changes in the design.

The question is intimately connected with that of the advisability of variable pitch. I have just mentioned the fact that for constant density a satisfactory propeller can be designed having constant pitch. Variable pitch is useful only for great altitudes. But then indeed it can greatly improve the performance of the propeller. The variation of the pitch enables the propeller to conform to an additional variation of the conditions, that is, the variation of the density of air.

Some designers of variable pitch propellers claim that the center of pressure of the blade sections of their propellers does not travel. Whether this be true or not, it has nothing to do with the variability of the pitch. For the travel of the center of pressure is due to the change of the lift coefficient of the blade elements, which always takes place for different conditions of flight, because the lift coefficient is nearly proportional to the thrust, and the thrust changes. Hence the center of pressure does not travel if the blade section used is one without travel of center of pressure, whether the pitch be changeable or not.

Proceeding now to the general layout, I have shown that the diameter must satisfy the condition:

$$(1) \quad D < \sqrt{\frac{T}{nV} \frac{CL}{CD} \frac{6}{\pi^2}}$$

where T denotes the thrust,
 ρ the density of air,
 CL/CD the lift/drag ratio of the blade section.

This equation gives too high a value for a small velocity of flight such as occurs during the start, for instance. CL/CD can be assumed to be 22. The diameter thus obtained is only a rough indication of the

upper limit; the weight, the stresses at the structural point of view are not taken into account. In general the diameter is given by other considerations, and the following method is valid for any diameter however determined.

After having made the decision as to the magnitude of the diameter, the required horsepower is to be estimated and compared with the horsepower delivered by the engine. The thrust horsepower may be written $N_0 = T V$. The sum of the thrust horsepower and slip stream loss is then

$$\frac{N_0 (1 + \sqrt{1 + C_p})}{2} \quad \text{where } C_p = \frac{\pi D n}{4 V^2}$$

The friction loss is $.033 N_0 \frac{\pi D n}{V}$. Hence the smallest brake horsepower possible is approximately

$$(2) \quad N_0 \left[\frac{1 + \sqrt{1 + C_p}}{2} + .033 \frac{\pi D n}{V} \right]$$

The factor 0.033 refers to average conditions and to a lift coefficient of the blade of about 0.4 to 0.8. For smaller lift coefficients the factor is greater, and for high it may be smaller, say up to $CL = 1$, and then greater for still higher lift coefficients. This depends on the blade section.

The next step is the determination of the number and breadth of the blades. First, the lift coefficient is to be assumed. The highest lift coefficient occurring ought to be about 0.80 to 1.10. It can be said that the lift coefficient is fairly proportional to the thrust. Its value to be chosen is therefore in the neighborhood of T/T_{max} where T is the thrust for which the propeller is designed and T_{max} the greatest thrust ever occurring for the propeller.

The lift coefficient being chosen, the product of the number of blades and the average breadth of each blade is approximately

$$(3) \quad i t = \frac{6 T}{CL \frac{\rho}{2} n^2 D^3 \pi^2}$$

This formula makes it possible to decide on the number of the blades and on the breadth.

The general layout of the propeller is thus finished and the design in detail can begin. First, the distribution of the thrust is to be decided upon. The coefficient of thrust is to be assumed, taking

$$C_T = 1.1 \frac{T}{q D^2 \pi} \frac{1}{4}$$

2/3 of the radius and

$$C_T = 1.1 \frac{T}{q D^2 \pi} \frac{2}{3} \frac{\pi n D}{V} \frac{C_D}{C_L} \frac{1}{V}$$

 the tip, where q is the dynamic pressure. For a very low velocity of flight, the last expression can be slightly decreased. This is, however, not yet the definite value of thrust coefficients at these points. A diagram is to be drawn now, plotting the thrust coefficient against the radius. The values just calculated are put in and connected by a straight line. Then the ends of the curve so obtained are rounded off. At the outer end the rounding may begin, say 10% of the radius from the end, and the curve may end elliptically. At the inner end, the thrust coefficient is zero over the hub, and near it, only a small possibility of thrust can be realized, say

$$\frac{1}{2} \left(\frac{\pi n r}{V} \right)^2$$

even the same expression with a factor smaller than $\frac{1}{2}$, if there are only two

blades and these narrow ones. This gives a limiting curve inside, which is to be rounded off where it intersects the first curve.

One must now see whether the curve of thrust coefficient thus obtained gives the desired thrust. The radius is to be divided into a number of equal parts Δr , say 10 parts. For each part the average value of the thrust coefficient is to be taken from the diagram and is to be multiplied by the radius r . All these products are to be added, and the sum A so obtained is to be multiplied by $2\pi \Delta r \cdot V^2 \rho / 2$, thus giving

$$T_1 = A 2\pi \Delta r V^2 \frac{\rho}{2}$$

Harold J. Powers, Pioneer in Radio Broadcasting

Harold J. Power of Medford Hillside, Massachusetts, according to an article in a recent issue of the National Magazine, deserves credit not usually assigned to him as a pioneer in radio broadcasting. Mr. Power is the first man in America to have established daily broadcasting, according to this article. The radio historians will have to decide between Mr. Power's station in this matter, and the Pittsburgh station of the Westinghouse Company (K D K A), which claims the same honor. True it is that Mr. Power did more than most men in pioneering radio transmission on a commercial basis.

Mr. Power was one of those boys who can't keep their fingers out of father's toolbox, and who are everlastingly tinkering with the telephone, the electric light circuit, or anything about the house that will give the mechanical genius a chance to tinker.

It was during a grammar lesson that I became interested in radio," Mr. Power says, "copying the sentence in my textbook which ran 'Marconi, the inventor of the wireless telegraph.'"

The little boy, who was already very much interested in electricity, ran right to work and began the business of building

This thrust will not agree exactly with the desired thrust T . Therefore all coordinates C_T are to be increased by the constant additional term $(T - T_1) / (.78 D^2 q)$. Then they represent C_T for each blade element, and the section of each blade element and its inclination can be laid down.

For the choice of the blade sections the same rules are valid as for the choice of wing sections. The angle of attack for the desired lift coefficient can be calculated or it can be taken from a model test. In the last case the induced angle of attack $C_L t$

— where b/t is the aspect ratio of the wing model, is to be subtracted from the angle obtained during the test. The drag too is to be reduced to a drag for infinite aspect ratio, and an additional constant reduction of the drag coefficient making the minimum drag coefficient 0.02, will improve the result.

HUGHES
 Let now δ be the difference of the angle ϵ of inclination of the blade element with respect to the propeller plane and the angle of attack β . This angle δ is to be determined by means of

$$(7) \quad \tan \delta = \frac{V/U + \tan \delta (1 + V/U)}{1 + \frac{2 \sin^2 \delta}{C_T} - \sqrt{\left(1 + \frac{2 \sin^2 \delta}{C_T}\right) - 1}}$$

where U denotes $2\pi r n$. This equation is to be used by substituting an approximate value of $\tan \delta = 1.1 V/U$ in the right-hand term. Sometimes the proceeding is to be repeated by substituting the value of $\tan \delta$ thus obtained. When $\tan \delta$ is found, the angle of inclination is

$$(8) \quad \epsilon = \delta + \beta$$

and the chord of the blade is obtained:

$$(9) \quad t = 4 \sin \delta \frac{\tan \delta - V/U}{1 + V/U} \frac{2\pi r}{i C_L}$$

For the analysis the following equations are used:

$$(10) \quad \tan \delta = \frac{4 r}{i t} \frac{1 + V/U}{\tan \epsilon (1 + V/U) \sin \delta + V/U}$$

$$(\tan \epsilon \tan \delta + 1)$$

$$(1 + V/U) \sin \delta + \frac{4 r}{i t}$$

$$(\tan \epsilon \tan \delta + 1)$$

$$(11) \quad C_L = 2\pi (\epsilon - \delta). \text{ With some sections, } C_L \text{ is slightly less.}$$

$$(12) \quad m = \frac{i t (\epsilon - \delta) \pi}{2\pi r \cdot 2} \frac{1}{4 m \cos \delta}$$

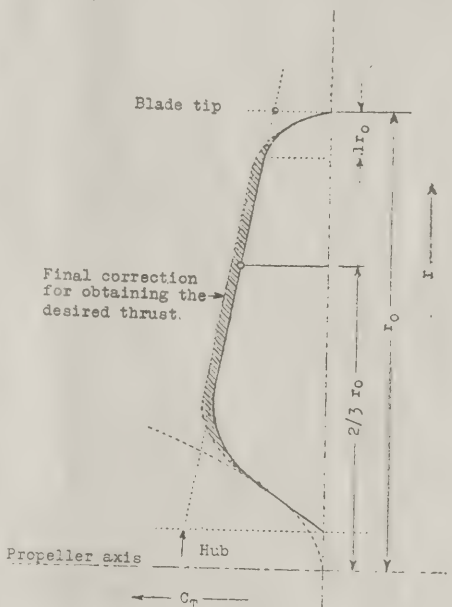
$$(13) \quad C_t = \frac{1 - m \cos \delta / \sin^2 \delta}{1 - m \cos \delta / \sin^2 \delta}$$

$$(14) \quad C_Q = C_T (\tan \delta + C_D / C_L).$$

$$(15) \quad T \approx C_T 2\pi r \Delta r V^2 \frac{\rho}{2}$$

$$(16) \quad \text{Torque} = \sum C_Q 2\pi r^2 \Delta r V^2 \frac{\rho}{2}$$

Equation (10) is to be used instead of equation (7), assuming that $\tan \delta$ lies between V/U and $\tan \epsilon$.



his own set. His first one stood on a table made from an old wooden box, and a wire strung from a post attached to the clothes pole in mother's yard constituted the antenna. The first message which he received (from the Boston navy yard) was the occasion in the middle of the night of an unceremonious rousing for all who had the fortune (or misfortune) to belong to the young experimenter's family or neighborhood.

"The story of Mr. Power's success," the writer of the article referred to, concludes, "is another proof that persistence is the forerunner to fame."

Tells How to Work Vacuum Tube Sets

Some good advice to the radio novice on the matter of adjusting and operating a vacuum tube set, always a troublesome matter even though the experimenter has constructed most of the elements himself, is given by Walter Remy in a book, "The Radio Primer," just published by Ralph T. Goodwin.

In explaining how to get results after the set has been correctly constructed and assembled, the writer says:

"After the tube was inserted in the socket the filament rheostat was turned until a slight hiss was heard in the phones. The tickler coil was set at an angle of 45 degrees with respect to the tuning coil and the variometer was rotated. If a click was heard, followed by a sound like that of escaping steam, the set was operating properly. With the receiver in this state the variable condenser was turned until a squeal was heard. This squeal is what is called the carrier wave of the radio telephone.

"The variometer was turned back again until the hiss and the squeal stopped and the variable condenser was moved a fraction of a degree until the radio phone was heard the loudest. The tickler coil was varied until the music or other signals were heard the loudest and the adjustment was left fixed. This adjustment did not have to be made again. The rheostat was varied to determine if any increase in strength of signal could be obtained. This latter adjustment was also permanent."

The new book is unusual in the recent outburst of radio literature in that it stays close to its subject, which is the construction and operation of a home radiophone, explaining the theory of wireless when necessary through simple analogies.



WAR DEPARTMENT

JUNE

June 7—AIR SERVICE SUPPLIES—Morrison, Va., Auction. For catalog write, C. O., Air Service Depot, Morrison, Va.

June 8—Q. M. SUPPLIES—Camp Jackson, S. C., Auction. For catalog write C. O., Q. M., Intermed. Depot, Candler Warehouse, Atlanta, Ga.

June 9 — ORD. MATERIAL — Springfield Armory, Mass., Sealed Bid. For catalog write, Boston Dist. Ord. Salv. Board.

June 14—Q. M. SUPPLIES—Atlanta, Ga., Auction. For catalog write, C. O., Q. M., Intermediate Depot, Candler Warehouse, Atlanta, Ga.

June 15 — HARNESSES — Washington, D. C., Sealed Bid. For catalog write Col. Warfield, 1222 Munitions Bldg.

June 15—PLANES—ENGINES—Washington, D. C., Sealed Bid. For catalog write, Chief, M. D. & S. Sect., 2624 Munitions Bldg.

June 15—Q. M. SUPPLIES—Chicago, Auction. For catalog write, Q. M. S. O., Gen. Intermed. Depot, 1819 W. Pershing Rd.

June 16 — CASTOR OIL — Washington, D. C., Sealed Bid. For catalog write, Chief, M. D. & S. Sect., 2624 Munitions Bldg.

June 15 — MOTORS — STEEL — Watertown Arsenal, Watertown, Mass., Sealed Bid. For catalog write, Boston Dist. Ord. Salvage Board.

June 19—Q. M. SUPPLIES—Camp Sherman, O., Auction. For catalog write, Gen. Intermed. Depot, 1819 W. Pershing Rd., Chicago, Ill.

June 22—Q. M. SUPPLIES—Boston, Mass., Auction. For catalog write, C. O. Q. M., Intermed. Depot, Boston.

June 27—Q. M. SUPPLIES—Norfolk, Va., Auction. For catalog write, Q. M. S. O., Gen. Intermed. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.

"Camp Grant Sale, scheduled for June 13, has been postponed to Aug. 3."

SEND FOR CATALOG

SELLING PROGRAM

JULY

July 6 — Q. M. SUPPLIES — San Antonio, Tex., Auction. Send catalog requests to Q. M. S. O., Ft. Sam Houston, Texas.

July 7—Q. M. SUPPLIES—Washington, D. C., Auction. Send catalog requests to Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.

July 11—AIR SERVICE SUPPLIES—Buffalo, N. Y., Auction. Send catalog requests to C. O., Curtiss-Elmwood Depot, Buffalo, N. Y.

July 12—Q. M. SUPPLIES—San Francisco, Calif., Auction. Send catalog requests to Q. M. S. O., Gen. Intermed. Depot, Ft. Mason, San Francisco, Calif.

July 13 — Q. M. SUPPLIES — Omaha, Neb., Auction. Send catalog requests to Q. M. S. O., 1819 W. Pershing Rd., Chicago, Ill.

July 13—Q. M. SUPPLIES—Chicago, Ill., Auction. Send catalog requests to Q. M. S. O., 1819 W. Pershing Rd., Chicago, Ill.

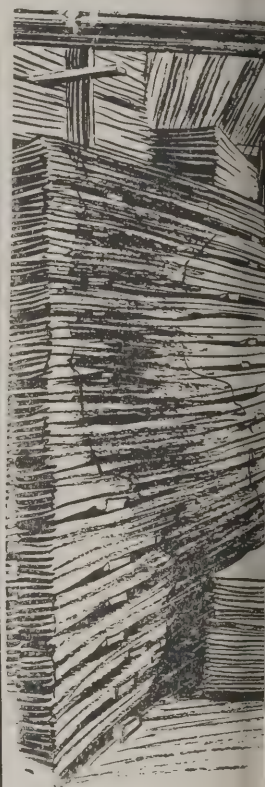
July 20—Q. M. SUPPLIES—Columbus, O., Auction. Send catalog requests to Q. M. S. O., 1819 W. Pershing Rd., Chicago, Ill.

July 25—Q. M. SUPPLIES—New Cumberland, Pa., Auction. Send catalog requests to Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.

July 25—Q. M. SUPPLIES—Camp Jackson, S. C., Auction. For catalog write, C. O., Q. M., Intermed. Depot, Candler Warehouse, Atlanta, Ga.

July 28—Q. M. SUPPLIES—Philadelphia, Pa., Auction. Send catalog requests to Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.

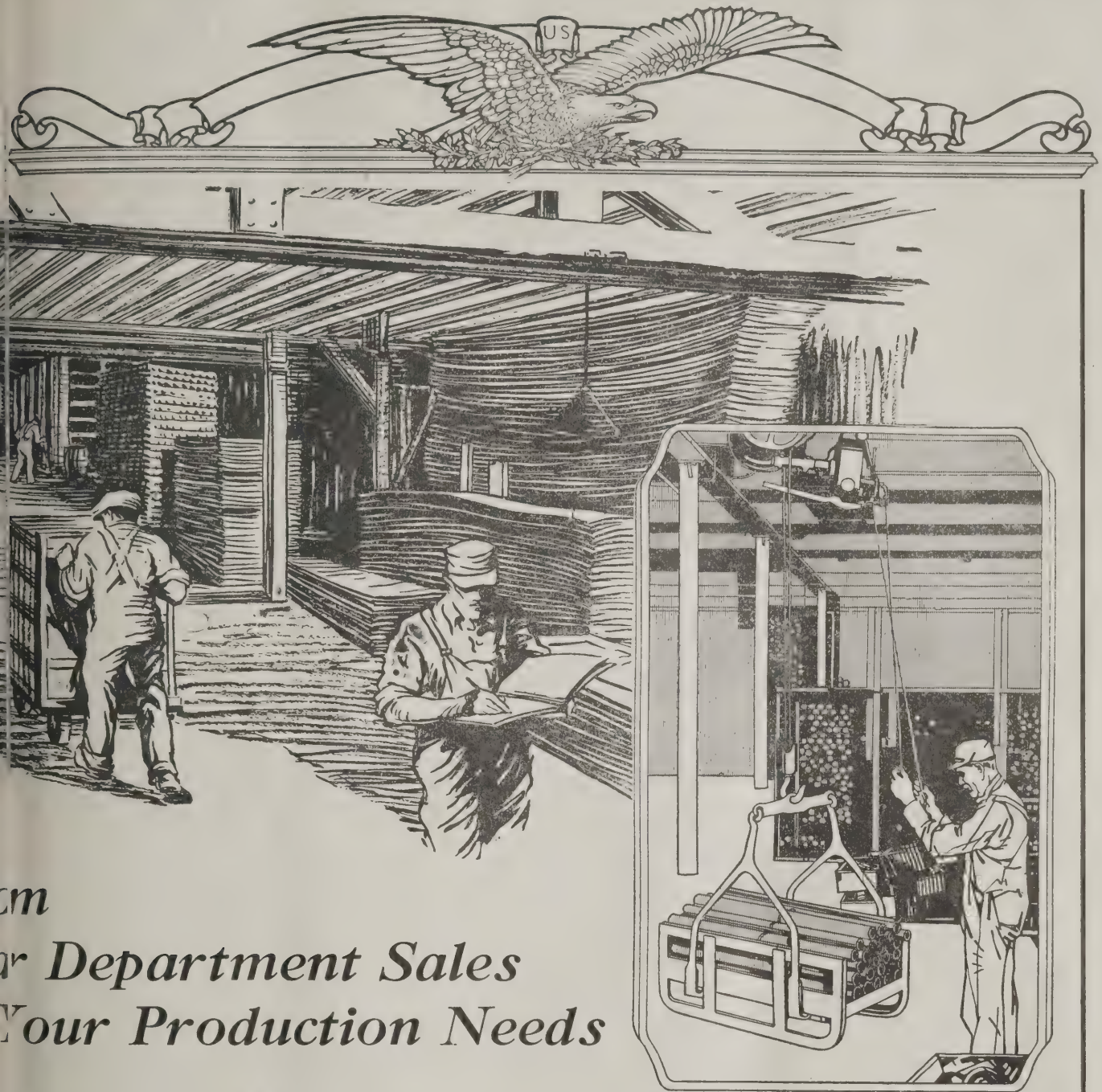
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THE list of sales left is an inducement of many offerings of material you will want to investigate. Detailed advertisements of each sale appear regularly in publication and in representative journals. Follow those advertisements and discover the benefits of the War Department as a source of supply. Check up the advertisements with the and make sure no things are overlooked. "The Government reserves the right to reject all bids."



WAR IDE



War Department Sales Your Production Needs

warehouses, the War Department has vast quantities of materials. They were bought to stand up under the usages of war, and they match in quality the materials which you are competing in the open market. They represent the money they represent, and they are not duplicated elsewhere in value.

Here is a source of supply it will pay your purchasing department to investigate. Sales are conducted virtually every week by auction or sealed bid. Follow the War Department advertisements, write for catalogs of materials you can use, and participate in the sales.

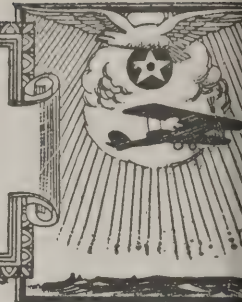
For Catalogs, Proposal Blanks and Full Information regarding all sales, write:

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W A R D E P A R T M E N T



NAVAL *and* MILITARY " AERONAUTICS "



Air Service Reserve Activities in Colorado

The headquarters of the 103rd Division, Air Service, was recently established in Rooms 210 and 213, Federal Building, Colorado Springs, Colorado. The office was opened up by borrowing a few small tables and chairs from the custodian of the building, pending the arrival of office equipment on requisition. A great deal of publicity was given concerning the establishment of headquarters by local newspapers, with the result that many inquiries were received from former service men and reserve officers located in and near the city of Colorado Springs. All who made inquiries were interested to know if, in joining the reserves, an opportunity would be afforded them to fly. All were anxious to get hold of the controls again and to keep up their training. The officer on duty with the Division Air Service at once set about to locate a suitable landing field where he could invite visiting ships to land, the information found in "Notice to Aviators" for January 1, 1922, concerning a field in this locality, not being reliable. An excellent field was located, and permission to use same has been granted by the owner. With the assistance and co-operation of a local flyer, a 40-foot white circle was made in the center of the field, and a standard wind sock placed at one end of a pole. This information, with a sketch of the field, was sent to the Chief of Air Service; Air Officer of the 8th Corps Area; Post Field, Fort Sill, Okla.; and Kelly Field, Texas.

The organization of the 103rd Division, Air Service, as to the assignment of officers is just about complete, there being a few vacancies yet in the grades of Captain and First Lieutenant, and a surplus in the grade of 2nd Lieutenant. Enlistments for the 103rd Division, Air Service, have not as yet been undertaken due to lack of a clerk and office equipment and supplies. Hope is entertained that this deficiency will be supplied in the very near future.

Air Service Detachment Returns from Germany

The Air Service Detachment, consisting of two officers and 83 men, arrived at Mitchell Field on May 4th, from Germany. This detachment was apparently assigned to Mitchell Field to be broken up and the personnel distributed to other Air Service stations. This fact is regretted very much by Mitchell Field, because it is found that the detachment contains some very excellent soldiers and mechanics. The officers reporting with the detachment, 1st Lieutenants Dogan Arthur and Russell M. Greenslade, Air Service, have been ordered to report to Langley Field and Kelly Field, respectively.

316th Reserve Squadron Gets Under Way

After many trials and tribulations the 316th Squadron has finally gotten under way. With the assignment of Captain A. F. Harold to duty as Air Officer for the 91st Division, the final obstacle to actual

work was removed. Two Hissos were acquired for the instruction of the pilots and an old DH for the instruction of the enlisted personnel. A staff sergeant and four specialists were detailed to temporary duty with the squadron.

Class instruction takes place every Monday night in the hangar which has been turned over for the exclusive use of the Reservists. On alternate Saturdays and Sundays practical ground instruction and flying takes place. The ground instruction is under Staff Sergeant Fowler (28th Squadron). The Specialists act as instructors in their respective specialties.

There are assigned for duty to the squadron 33 officers, leaving a shortage of only two for the full 100 per cent. Enlistments are being sought, it being the intention to enlist the men in a body when a complement of about 50 per cent of the authorized strength has been acquired. About 25 men are now taking instruction.

The 316th Photo Section has its full officer personnel, and is about ready to enlist its full quota of men.

Reserve officers have flown approximately ten hours during the week of April 25. A shortage of oil compelled the cessation of flying. Lieuts. Farmer, Kearny and Cavagnero have successfully soloed during the week. Hopes are being entertained that all the officers of the organization will take advantage of the opportunity and take a refresher course soon.

Post Field Fliers Visit Muskogee, Okla.

Fourteen ships (DH's) from Post Field, Fort Sill, Okla., paid a visit on Saturday, April 22, to Muskogee, where the Headquarters' 95th Division, Air Service, is located.

Major Thomas G. Lanphier, Officer in Charge of Flying at Post Field, with Captain Alexander Mileau, Flight Surgeon at Post Field, was in charge of the flight. Captains Vernon L. Burge and Frank L. Pritchard were the other officers of the permanent garrison making the flight. The following student officers of the Air Service Observation School, for whom the flight was a practice cross-country flight, were among those present: Captin De Ford, Captain Derby, Lieutenants Shrader, Vidal, Wisehart, Davidson, Stackhouse, Shen (Royal Chinese Navy), Cooper (Chile), Evert, Williamson, Peck, McBlain, Schabacker, and four mechanics.

Captain Charles B. Oldfield, Executive Officer of the 95th Division, Air Service, was on the field to meet the visitors. After all had arrived, Major Lanphier led a five-ship formation over Muskogee; with Captain Oldfield and Lieutenants Vidal, Shrader and Davidson following.

The secretary of the local Chamber of Commerce, Mr. Lydig, was on hand to greet the visiting fliers, as were also newspaper representatives and a number of citizens of Muskogee. Each visitor as he arrived on the field was given a complimentary card by the secretary of the Chamber of Commerce which entitled him to hotel accommodations at one dollar per day, 20 per cent off on all meals and free admission to the ball game.

Flying Activities at Carlstrom Field

The records of the Flying Officer Carlstrom Field, Arcadia, Fla., show a total of 65 student officers and cadets in primary flying instruction during the month of April. A total of 5 officers and 13 cadets were relieved from further instruction during the month by the Academy Board. The total man hours flown during April was 2,174.55, aircraft hours flown 1,480:20.

Elimination Contest at Scott Field

In preparation for the National Balloon Race to be held at Milwaukee, Wis., May 31st, an elimination contest was held on Saturday, May 6th. Two balloons of 19,000 cubic feet capacity were used, first piloted by Lt. J. W. Shoptaw, Carlstrom Field, with Lt. Courtland Brown as co-pilot and the second piloted by Lt. J. H. C. H. Scott Field, with Lt. James Healy as co-pilot. Both balloons covered in the neighborhood of 110 miles, but Balloon No. 1, though holding a few miles advantage over Balloon No. 2, was in the air fifteen minutes longer. The race was so close that data has been sent to the Chief of Air Service for his award.

Major Fitzmaurice Retires from Active Service

Major William J. Fitzmaurice, Air Service, who has been in command of the Montgomery Air Intermediate Depot since October, 1920, has been retired from active duty with the army, and will be succeeded in command by Major Roy S. Brown, commanding officer of the 22nd Squadron.

Major Fitzmaurice began his military career upon entrance to West Point Military Academy in 1904. He graduated there from in 1908, and was appointed a Lieutenant of Infantry. During his twenty years of service he has filled many important positions of responsibility. He served foreign service in Alaska, Panama, France and Germany. It was while on duty in Germany that he met with a most severe and painful accident, which caused physical disability and consequent retirement. A rifle he was using exploded, and particles of steel entered his right eye.

The last official ceremony, in which Major Fitzmaurice received the officers' troops in his command, was held on the morning of May 2nd. He addressed the men, expressing his satisfaction and appreciation of the cooperation from officers and men that has made the 22nd Squadron and the 4th Photo Section successful. He expressed regret at leaving the military service and in parting with the personnel of the depot and his many friends in Montgomery.

Major Fitzmaurice intends to make his home in Los Angeles, Calif., where his parents now reside.



FOREIGN NEWS



Aerial Map of Capetown

Taken after much patient manoeuvring by aeroplane, an aerial plan of Capetown's business centre has been photographed and issued for guidance of all concerned, reports the *Cape Argus*. This novel guide is a reproduction of composite photographs of central Capetown, the ding buildings being neatly labelled. The result is a startlingly graphic picture, which is unique, so far as South Africa is concerned. A key of the plan indicates more clearly the exact position of any given building, which a number is assigned. Guided by the number in its sequence, a person interested can follow up his investigations at the foot of the map. The map is published by Mr. Ken Donaldson.

The French Engine Competition

The regulations for the French contest for aero engines which is to be held during 1924 have just been issued. This contest, which is due to the initiative of the Comité Française de Propagande Aéronautique, is supported by the Under Secretary of State for Aeronautics. The Committee and the French Air Ministry have each assigned a sum of one million francs for the purpose of the competition. The million allocated by the Government is to provide two prizes each of 300,000 francs for engines of French origin, and the million allocated to the Committee is to be devoted to purchasing for the benefit of the French Government the French manufacturing rights in the engine which is adjudged to be the best. Engines of any origin—except those from enemy countries—are eligible for the competition, but not for the two prizes above mentioned as reserved for French engines. In the event of the winning engine being of foreign origin, in addition to the sum of one million francs, provision is made for the payment of a prize at a maximum rate of 8,000 francs per engine for the first 100 engines built, decreasing 1,000 francs at each 100 engines till the 600th, thereafter a uniform maximum royalty of 2,000 francs per engine is payable. Entries will be received up to December 1, 1922, by the Commission of the Aero Club of France if accompanied by an entrance fee of 20,000 francs. Entries will be received up to December 1, 1923, on an entrance fee of 40,000 francs. Foreign competitors will in addition be required to contribute 10,000 francs toward the cost of testing. Half of the entrance fees will be returned to all competitors who pass the eliminating tests. The special contribution of 10,000 francs from foreign competitors will be returned to those who may withdraw before the official opening of the trials. Engines must be of the internal combustion type, and of a normal output of between 350 and 450 h.p. The weight per h.p., including the weight of fuel and oil for 5 hours, must not exceed 3.3 kg. per h.p. The speed of rotation of the airscrew is not to exceed 3,200 r.p.m. All engines are to be fitted with a self-starter such that the engine may be started at a distance without turning the engine by hand. This starter is to be used for starting during the whole of the trials. Engines will be required to undergo eliminating trials, including five hours' run on an air brake on the test bed, and two hours' flight on an open plane which is to be provided by the entrants. Hereafter the engines will be submitted to an endurance test totaling 240 hours' run in thirty periods of 8 hours each on the test bench. This is to be an air brake of the airscrew type, supplied by the competitor, the engine will be mounted on a pivoted test bed, which will allow measurement of the brake h.p. The first 240 hours' run is required to be made in not more than 10 days—not more than one run per day—and penalty marks will be added for every delay in starting, for every stoppage during a run, for every day taken to complete the tests in excess of the possible minimum of 10 days, and for every repair and replacement made during the whole of the trial. Any individual run may be annulled on account of delays in starting, stoppages, or failure to develop the required power. The whole endurance test may be annulled if more than 10 such runs have been annulled, if more than 30 days elapse between any two consecutive 8-hour runs, or if the total of repairs or replacements exceed certain specified limits. A second attempt may be made, but is to be completed in 80 instead of 100 days. Such a second attempt is attended by penalty marks. Penalty marks are to be awarded for the weight per h.p., with five hours' fuel and oil, as determined from the actual consumption and power developed during the trials. If the weight per h.p. so computed is more than three per cent. the marks are penalties; if less, they are set against penalties. Penalties are inflicted for the air resistance of the engine, which is measured as proportional to the area inside the smallest convex contour which will entirely enclose the projection of the motor on a plane normal to the airscrew axis. This area, divided by the normal full power of the engine, is the basis of the penalty marks. The sum of all penalties, less any good marks for low weight per h.p., will serve to classify the competitors, the lowest total being that of the winner. One of the 300,000-franc prizes for French engines will be awarded on this same basis. The second 300,000-franc prize will go to the French engine which gives the best results on the two points of weight per h.p. and head resistance. Complete details of the rules, conditions of entry, and so forth, may be obtained on application to the Commission d'Aviation de l'Aéro Club de France, 35, Rue François 1er, Paris. The system of penalty marking laid down in the regulations for this competition has certain very interesting and somewhat ingenious features. The system has obviously been devised with the intention of eliminating as far as possible the effects of accidental ill-chance on the prospects of a good engine, and of penalizing very severely any form of consistent bad behavior. Penalties are imposed for all delays in starting, and for stops during the runs. These penalties vary with the time of delay or stop. If the delay does not exceed one hour, if there is not more than one stop in a run, and that stop is of less than one hour, the penalty on the score of the run or delay goes no further. But if either stop or delay exceed one hour, or if there is more than one stop, the run is annulled. There is a penalty for annulment, and in addition a further penalty for the extra day taken to complete the 240 hours' total. If the stop or delay involves the repair or replacement of any part of the engine, there is a penalty for that repair or replacement. This penalty is inflicted for repairs, etc., even if it does not lead to delay or stoppage. The

penalties are thus cumulative, and increase as their effects become more serious.

But the method of penalizing for repair and replacements is extremely ingenious. There is a basic scale for these, the penalties increasing with the time needed to carry out the work, whether the work is of a nature which allows immediate resumption of the test, or necessitates "tuning up" and preliminary running before continuance of the tests. Also generally the penalties for the replacement or repair of an isolated piece are less than are those for a complete unit. That is, it is cheaper to replace a big-end bush than a complete connecting rod unit, and it is cheaper to replace an accessory unit such as a magnet than an essential of the engine, such as a complete cylinder. This is quite apart from penalties which arise from the delay in carrying out the change.

But the basic scale applies only to the first time of repairing or changing a given unit or type of unit. Wherever a part has already been changed or repaired the penalty for change or repair to a similar part (not necessarily the same part) is to be that in the scale, multiplied by the total number of changes or repairs to the same part or type of part. From this rule plugs and valves are excepted. In their case the penalty is imposed plus the number of preceding replacements.

The effect of this rule is that the tenth defective water or oil joint to be replaced during the tests will involve a direct penalty as great as that due to the changing of a crankshaft or cylinder. Thus silly little failures due to faulty design or workmanship which recur continually are very heavily penalized, while a more serious breakage which may be due to an undiscoverable flaw or to some accidental mischance does not necessarily put an engine out of the contest.

Aerial Transportation in Europe

Consul Dreyfus, Dresden, reports to the Department of Commerce that on April 1, a daily passenger, mail, and freight air service was re-established on the line Dresden-Berlin-Hamburg and return; also on the line Dresden-Leipzig-Magdeburg-Hanover-Bremen and return. The trip from Bremen to Hamburg takes four and one-half hours, including a half-hour stop in Berlin. The journey to Bremen requires five hours, including 15-minute stops at Leipzig, Magdeburg, and Hanover.

The fare from Dresden to Berlin is 500 marks and from Berlin to Hamburg 650 marks. This compares with 285 marks and 387 marks, respectively, for the first-class railway fare between the same points. Passage from Dresden to Leipzig is 500 marks and from Leipzig to Bremen 1,300 marks, as compared with 190 marks and 536 marks, respectively, for first-class railway fare between these points. Fifteen kilos of baggage is carried without charge, and all excess at the rate of 15 marks per kilo.

It is reported that a service from Dresden to Prague will be inaugurated in June.

Acting Commercial Attaché Cross, Brussels, reports that the "Snet," a Government-subsidized aerial transportation company in Belgium, has finished its trial period of passenger, merchandise, and postal aerial transport service between Brussels and cities in neighboring countries (Paris, London, Amsterdam, The Hague). Belgian participation on these lines will, therefore, cease from June 1, 1922, leaving the Paris-Brussels and Brussels-Amsterdam services in the hands of French and Dutch companies. A Brussels-London service will be organized by an English company, beginning in May of the present year.

The Belgian Government is studying the creation of a permanent organization which will permit that country to conserve an important position in international aerial transportation.

London-Brussels Service Inaugurated

May 8 saw the inauguration of the new aerial passenger and goods service between Croydon and Brussels, which is being run by the Instone Air Line, under the Government subsidy. The first machine, D.H. 34 G-EBBT "City of New York," piloted by Mr. Barnard, and with passengers, left the terminal aerodrome at Croydon shortly after 10.30 a.m., the departure being witnessed by the Hon. Capt. Guest, Minister for Air; Major-Gen. Sir Frederick Sykes and many other well-wishers of commercial aviation.

This flight was only in the nature of a preliminary trip, a regular daily service being arranged to start on Monday next. It is of interest to note, however, that permission to fly over the Royal Yacht, on its way across the Channel, in connection with the Royal visit to Belgium, had been granted by the King. The machine arrived safely at Brussels at 12.50, having taken two hours two minutes to complete the journey—quite good going. The return trip to Croydon was made later on the same day; photographs for the press of the Royal visit in Belgium forming an important item carried on the machine.

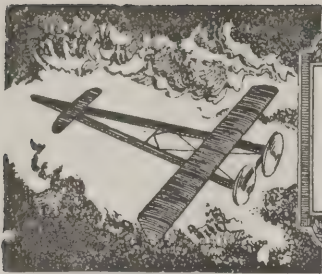
Owing to the engineers' strike, delivery of new machines has been considerably delayed, but it is hoped that before long the Instone fleet will comprise ten passenger machines and two specially built cargo machines, when a regular and frequent service to and from Brussels will be run without in any way interfering with the London-Paris service. Arrangements are being made to book through passengers via Brussels to all parts of the East by air. Passengers will be able to go to Brussels by air, spend a few hours, and return to London the same day—which should be a great boon, not only to tourists, but to commercial and business people. It is also the intention of the Instone Air Line to run a service to Ostend during the summer months, whilst negotiations are taking place with the diamond merchants to run a "special" once a week to Antwerp, returning the same day.

The London-Brussels route will prove to be an extremely useful one, for Brussels should form an important junction for the various lines to Northern and Central Europe.

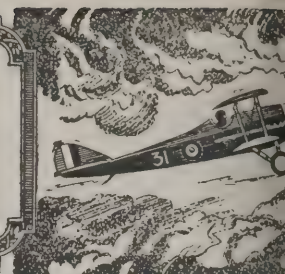
Rio de Janeiro and Porto Alegre Air Service

The Brazilian Government has been authorized to establish two aerial routes and air craft services between the cities of Rio de Janeiro and Porto Alegre, an overland route for aeroplanes and a seaplane route along the coast. Both of these routes will, it is proposed, be ready by September, 1922. Although the routes are intended primarily for use by the military and naval forces, and will be organized and controlled by the Ministry of War and the Ministry of Marine, respectively, the facilities they afford will be available for civil purposes, subject to the consent of the Government being obtained, and the payment of a fee and charges for material used.

The Decree authorizes the Government to borrow, up to a maximum of 4,000,000 milreis, to cover the cost of the scheme.



ELEMENTARY AERONAUTICS and MODEL NOTES



Scale Models Constructed by Aerial Age Readers Curtiss JN4D built to scale of 1 inch to the foot

Patterning his model after a JN plane owned by the North-Eastern Aeroplane Co. of Rochester, N. Y., Walter M. Fitch of Canadagua, N. Y., has completed a scale model which is one-twelfth the size of the original. Great care was taken to carry out all the details and the result is a realistic reproduction. Our readers will recall the Thomas-Morse Scout model built by Mr. Fitch, and illustrated in the January 2d issue of AERIAL AGE.

The description of the JN4D is as follows:

Wing span	43½ inches
Length over all	27¼ inches
Wing chord	4⅞ inches
Gap between wings	5 inches

Fuselage

Longerons are of ⅛" spruce

The cockpits have aluminum seats padded with patent leather. The controls are only in the forward cockpit. On the dashboard of the front cockpit are tiny reproductions of the following instruments: Altimeter, Tachometer, Clock-Compass and very small dials to represent the oil and water-pressure gauges. Both cockpits are equipped with throttles and "sparks" which were cut from aluminum.

Celluloid wind shields are placed in front of both cockpits and rubber tubing padded with fine silk is used to imitate the padding on the big ship. A dummy gasoline gauge is in front of the wind-screen of the first cockpit.

The motor cowlings have openings cut in the usual shape. inspection doors open and are hinged on the inside by means of adhesive tape.

Motor Group

The propeller is patterned after the "D-5,000" type, the kind used on the JN. The "prop" has 5 laminations which are each 1/32" in thickness. The aluminum flange has 8 tiny nails in it to imitate the bolts on the real plane and the hub has a tiny bolt to give a realistic effect.

The radiator was cut from a piece of white-wood. It has 4 lines of wiring to give the "honey-comb" appearance.

Each cylinder was made separately. Rocker-arms were made on strips of aluminum carefully bent and the springs were made of coils of very thin wire.

The eight cylinders were all glued to a piece of ply-wood attached to the upper longerons.

Intake pipes are of ⅛" round wood.

Exhaust pipes are of ⅛" material also and are painted black, but the remainder of the motor is given a coat of grey aluminum.

Undercarriage

The struts of the landing gear are carved from white-wood; streamlining is carried out and silk thread wound around at the proper intervals to imitate the linen thread material which is on the big aeroplanes to strengthen the struts.

Axle is brass, the wheels aluminum with pneumatic tires, and the thin strands of rubber band act as shock-absorbers.

The tail-skid also shock-absorbs and has a "shoe" of aluminum.

Empennage

Control horns were cut from white-wood.

Single strand wire is used to brace the control pylons and the wires running from the control horns are double twisted in order that the wiring may appear like stranded cable.

The hinging is carried out in the same manner as on the large plane.

Stabilizer braces were cut out from ply-wood.

The rudder is painted a blue, with the letters, "2 ROCHESTER, N. Y.," in black.

Panels

The wings are made of bass wood; the ribs being made to scale of the "Eiffel No. 36" wing curve. Near the tip of the trailing edge of the lower left wing the angle of incidence is decreased and on the right wing vice-versa, this done to give the "wash-out" and "wash-in" effect. The "sidewalks" on the lower wings are made of aluminum. The wing-skids are of reed, steamed to the proper shape.

The wiring on the wings is carried out in detail, the landing wires being single, the flying wires double.

Aileron cables are of waxed thread in order to insure good working order. Aileron wheels are made of ply-wood and are ¼" in diameter.

Each upper wing has 18 ribs and the lower 14, as on the ship.

Over each rib (on wings and empennage) is glued a s of paper roughed on the edges to represent the frayed c which covers the ribs on the original.

Struts are made of white-wood and numbered to indicate their proper location, as on the big ship.

General Notes

The model is painted with the Army "OD" color, which greenish khaki, but the rudder and circles on wings are blue.

All the struts are stained with 2 coats of light oak.

Lastly, the model is finished off with a coat of very v varnish.

A Curtiss-Navy Racer Model

Mr. Bartle J. Allen of 681 Orchard Avenue, Bellevue, followed the outlines and suggestions for building a fly scale model of the Curtis-Navy Racer as published in the ruary 13th issue of AERIAL AGE.

Although no long distance flights have been accomplished the model has "hopped" from forty to fifty feet.

With little additional weight, the fuselage was coated v aluminum paint which adds very much to the appearance. order to secure the maximum efficiency, a standard prop was used.

The balsa body is a very light and strong construction, weighing only a little over two ounces. Although very light c struction methods were followed throughout, the model is v strong and effective.

The National Scientific Society

The National Scientific Society, founded at Cooper Un consists of students of Chemistry and Engineering. Among various departments, the "Aircraft" and "Radio" departments are in majority. It is a society founded for the purpose "creating and fostering a craving for things scientific" and assist, financially and morally, any one or group of memb who may be engaged in research or experimental work in a phase of Engineering or Chemistry."

The following is the progress of its "Aircraft Engineering Department":

The membership of the department has reached forty-f and is rapidly increasing.

Ten models have already been completed and are ready experimentation. The models consist of rubber power-pl and otherwise.

The department has procured the use of the Cooper Un Laboratories.

Arrangements are being concluded between the society a various model aircraft clubs over the world for the purpose formulating laws so that international competitions may be h on model aircraft on a recognized basis.

Communications are invited from model clubs, particula collegiate clubs, to join in this alliance.

The society invites communications from any model aircl clubs interested in international competitions.

All correspondence should be addressed to Mr. Jacob Kuschner, president, Chapter Alpha, National Scientific Soci Cooper Union, New York City.



Models of two Curtiss aeroplanes: above, the JN4D, built by W. M. Fitch; below, the Navy Racer, built by B. J. Allen



RADIO DIGEST



Government Revenue for Radio Messages Increases

The revenue derived from private and commercial radio messages dispatched from Government stations shows an increase of 20 per cent in 1921 over the year 1917. The earnings of these stations is estimated to be in excess of \$1,600,000 and shows a profit of more than 15 per cent on the Government's investment of \$25,000,000. In 1917, the first year in which commercial and private messages were transmitted by the Government, the amount received from this source was \$32,249.34. In 1918 this revenue was increased to \$291,003; \$221,171.79 in 1919, \$641,584.90 in 1920 and \$666,362.44 last year.

Approaching Storms Detected by Radio Lose Their Terror

Detection of approaching thunder storms and time to make necessary adjustments in operation of electric service is a valuable practical use of the radio, according to the report of the electrical apparatus committee of the National Electric Light Association presented at the convention in Atlantic City. The radio also serves to detect defects in electrical apparatus and equipment more efficiently than any other agency, the report says.

The entire radio art has reached an eminently practical and dependable stage," the report continues. "Transoceanic telephony on a basis comparable to that of the cables probably represents both the greatest achievement and the most spectacular operation. The marine use of radio, including not only ship communication but also position finding for vessels at sea, is of tremendous importance. In Europe wireless telegraphy is coming into extensive use for intercity communication. Some attempts in this direction have also been made in the United States.

The broadcasting of news and weather dispatches, musical and other entertainments, speeches and church services by radio telephone is providing a valuable service to hundreds of thousands of listeners. Radio has also proved its importance as a wire line auxiliary in the radio field. Train dispatching by radio has been accomplished many times, and some far-flung railroads have installed radio equipment as part of their permanent plant."

Communication between plants and substations, transmission of instructions to repair gangs along the lines and the possibility of the remote control of switches are given as some of the immediate and important applications. Installation of receiver outfits on automobiles and motorcycles made where portability is desired. A wide field for remote operation of substations and switches is opened by the application of what is known as the "wired wireless."

Not the least interesting outgrowth of the short-wave telegraphy," says the report, is the application of its principles to communication along wires. It has been found entirely feasible to associate a radio transmitter with a wire system running from one point to another (even though that wire were used for power transmission) and to send along the wire a series of radio-frequency current waves which may be detected at the distant end by means of a simple radio receiver. Such "wired wire-

less," as the arrangement is frequently called, permits considerable economy in operation. It is claimed for this system that fairly clear telephone communication is possible even with lightning storms over the main line and with all but one of the power wires cut or grounded."

Within the last year, and even in the last few months, a number of steps which mark notable progress in radio have been made, the report says.

"Both transmitters and receivers have been improved in effectiveness, economy, reliability and convenience of operation. In radio telephony substantial improvements have been made in clarity of speech transmission, so that now the radio gives a definiteness of articulation far surpassing the wire telephone. Loud speaking apparatus has been developed to the point where purity of reproduction is not sacrificed to gain sufficient intensity. It is now possible to secure reliable radio service of a character never before even approximated."

Nation's Time Governed by Radio Daily

Shortly before 10 o'clock, Eastern Standard time, every evening in half a million homes the ticking of a distant clock is now heard, and the time of as many citizens is daily regulated by it. The ticks come from the clock in the Naval Observatory and are transmitted through the famous long-distance station at Arlington, Va.

Not only do these ticks regulate the nation's clocks throughout the Eastern section of the country, but they also figure very materially in the navigation of practically every steamship plowing its way across the waters of the Atlantic.

How are these signals sent out so regularly and consistently, and how are they reproduced from the broadcasting stations? That is the question that is of the greatest interest to the radio fan.

In the first place, the signals themselves are produced by the clock in the Naval Observatory in a very novel manner. The pendulum on the clock, swinging across its arc of travel, makes contact with a piece of metal every time it passes through its perpendicular position, and it is so arranged that it makes one complete swing every second.

As the pendulum passes across the contact it closes a local circuit, which in turn operates the transmitting apparatus at Arlington and thus sends out the brief dashes that are so familiar.

Now, as is well known, these signals are sent out on a wave of 2,600 meters in length, while the broadcasting stations are operating on 360 meters. The consequence is that the broadcasting stations which reproduce them must actually receive, and transmit at the same time.

This fact is not generally appreciated by the average radio fan, and it offered a very serious problem to solve, especially as it was desired to reproduce in all faithfulness the exact note of the Arlington station. It must be realized that in the case of the broadcasting station the receiving aerial is not more than a few feet away from the transmitting aerial. The problem, therefore, was to eliminate the inductive and radiation effect of the transmitting aerial from the receiving aerial so that it would

not interfere with the true note of Arlington.

Another difficulty that had to be overcome was the amplification of the weak signals received from Arlington without distorting them or changing their characteristics, because as received they were too weak to operate upon the transmitting apparatus of the broadcasting station.

I have listened several times on sets so arranged that it was possible to change quickly over from the 360-meter wave length to the 2,600-meter wave of Arlington, and the astonishing thing was the wonderful exactitude of the reproduction from the station broadcasting.

At the broadcasting station radio amplification is used to build up the current received in the antenna there before it is passed for rectification through the detector tube. The audible frequency of the Arlington quenched spark is then passed through audio-frequency amplifiers, and finally delivered into a special telephone receiver.

This receiver is attached to a telephone microphone transmitter of special design, and then placed into the modulator tubes of the transmitting apparatus and re-radiated on the 360 meter wave, so that all of the radio fans listening on their short wave receivers can obtain the correct official time every evening.

The remarkable thing about the whole transaction is that there is absolutely no loss of time in the transference from one wave-length to the other, and this is a very important factor to those who desire to set chronometers by means of the short wave reproduction of the time signals.

The manner in which the signals are transmitted from Arlington is as follows: The ticks are reproduced, starting from 9:55, Eastern standard time, every evening. Each second is sent out as a short dash, which is reproduced in the telephones. The tick of the twenty-ninth second of every minute is skipped, leaving quite a distinctive space. At the end of each minute the signals are omitted for several seconds, making a longer pause. At the end of the fifty-ninth minute after 9 o'clock the signals are omitted for ten complete seconds, which, of course, is much more noticeable. This longer pause also permits the operator of the broadcasting station to announce over the 360 meter wave his famous: "The next dash will be 10 o'clock."

One of the officials of a broadcasting station made the following suggestion:

"A convenient way to check your watch is to follow the second hand during the first part of the signals, thus noting the position of the second hand relative to the end of the minute. The minute hand should be observed during the fifty-ninth minute and checked with the signal for 10 o'clock. In this way you can tell exactly how many minutes and seconds your watch needs to be changed in order to absolutely correct time."

Radio Cuts Message Cost

It is estimated that by using radio to keep in touch with various army headquarters and posts the War Department will reduce the communication expense more than 40 per cent. Formerly all offi-

cial messages were dispatched over the wires of the commercial telegraph and telephone companies. Radio now is used almost entirely.

Double Circuit Set Reduces Interference

How can I eliminate interference from other stations? That is the question which bothers most of the radio fans, and the answer to it is bound up in the construction of the receiving set itself. A large number of sets now on sale, and in use employ what is known as a single circuit receiver. They have been so designed because of the desire to give to the novice an instrument that will be as simple as possible to operate and to adjust. For the purpose of selectivity, however, such a set is not nearly as efficient as a double circuit receiver.

In this article, I propose to outline the functioning of the double circuit set and in doing so it will be necessary to describe the vario-coupler and the loose coupler and explain the manner in which both of these two instruments operate. It will be helpful to those who are making or assembling their own equipment, as well as to those who have installed sets that are manufactured complete. In the first place, with a double circuit receiver, we have two complete and independent circuits, as the name naturally implies. The first is the aerial or antenna circuit, which consists of the aerial and an aerial tuning inductance and a ground connection. In some cases, the addition of a condenser in series with the aerial and the tuning inductance is included. This description of the aerial circuit sounds imposing, but in reality it is very simple and merely consists of the aerial wire and then the primary winding of the vario-coupler, or the loose coupler—whichever is used.

The next circuit is called the secondary circuit and consists of an inductance and a condenser. Now these two circuits taken together form what is technically known as oscillating circuits, or in plainer language the circuits which handle the high frequency currents picked up out of the ether.

The object of using two circuits is as follows: By carefully adjusting the aerial circuit we set it into resonance with the station we desire to listen to, just in the same manner as two tuning forks pitched to the same tone are in resonance with each other. In the natural course of events, however, every electro magnetic disturbance in the ether passes over the aerial to the ground. If the aerial circuit is not in resonance with any particular wave, it will not oscillate to it—that is, theoretically it should not do so. In practice, however, we find that it does, and this is the cause of interference which of course will be recorded into telephone receivers where only a single circuit is being used. Now, with the addition of a secondary circuit, which is also carefully adjusted, we eliminate still further the possibility of interference by increasing the number of circuits that have to be in oscillating resonance with each other.

There are two main methods of installing a double circuit receiver—one is by the use of a loose coupler, which is now more or less discarded, and the other is by means of the vario-coupler.

The loose coupler consists of a primary inductance, which is nothing more or less than a wire wound around an insulated tube in such a way that we have a certain number of turns on the tube. The more turns of wire there are upon the tube, the longer is the wave-length that it will respond to.

The secondary of a loose coupler consists

of a winding on another tube, which is so arranged that it will slide in and out of the primary tube. In fact, it will come completely out of the tube, and can be pulled away quite a few inches clear of the primary tube. In this manner we have three possible adjustments—first, the number of turns on the primary that we can bring into play in the primary circuit; second, the number of turns that we are bringing into the secondary circuit, and finally the inductive relationship between the two coils themselves, which is technically known as “close” or “loose” coupling. The object of this loose coupling is to eliminate the effect of interference by loosening the coupling between the two coils. It has been found in practice that when the primary and secondary circuits are in resonance with each other the two coils can be separated quite a distance and signals still be recorded in the telephone receivers, whereas signals that are not in resonance with the circuits will be eliminated by widening the coupling between the two coils.

Experience, however, showed that there was a considerable inductive loss when loose coupling was used and this led to the development of the vario-coupler, which is a much more efficient instrument. It has this drawback, however, that the secondary winding is not variable, but this is overcome by the addition of a variable condenser placed across the ends of the secondary coil.

Now the vario-coupler consists of a primary exactly the same as the primary of the loose coupler, although it is invariably wound on a tube of larger diameter. The secondary is wound on a ball, or rotor, which is so arranged inside of the primary tube that it can turn around in a complete circle. When the windings of the secondary of the vario-coupler are exactly parallel with the winding on the primary, there is a maximum induction between the two. This induction is decreased by turning the secondary, or rotor, in such manner that the windings assume an angular position in relation to the primary winding. This has the same effect as withdrawing the secondary in a loose coupler, but it has the advantage of not taking the secondary coil out of the maximum electro-magnetic field, and in this manner we obtain much greater efficiency in operation.—Jack Binns in *N. Y. Tribune*.

How to Keep Radio Safe in Lightning

One of the most debated questions among radio amateurs and broadcast listeners is whether a man who hangs out an aerial hangs out at the same time an invitation to every lightning bolt in the vicinity to come and pay him a visit. The warmth of the debate reaches its greatest height when one of the participants is the unscientific but forceful landlord of an apartment house and the other is a tenant.

The question is answered by G. K. Thompson, radio superintendent of the American Radio and Research Corporation, as follows:

“You should harbor no fear that your radio installation will attract lightning. The chances of lightning striking your home this summer are no greater than the chances last summer. You should make it a point, however, to install such safety devices as will render harmless the currents induced in your antenna by lightning bolts striking in the neighborhood.”

Mr. Thompson, in discussing lightning, divided the subject into three parts, the

protection of the house, the operator and the set.

He suggests for the house the installation of a lightning switch or a ground short gap of approved design, avoiding purchase of slate base, switches, gaps or other devices, which do not support ground conductor at least five inches from the wall of the building. A ground conductor should be used, run directly as possible to a good ground connection, such as a water pipe.

“Have the installation approved by your local inspector,” he advises, “so that in case any damage to the building by lightning ever comes to pass, the validity of radio installation will not be questioned.”

In considering the protection of the radio set itself from possible damage from high electrical discharges Mr. Thompson says:

“The best precaution to follow is to disconnect the antenna and ground lead wires from the terminals of the set before a thunderstorm breaks. If you do not care to disconnect the set a protected gap should be purchased and connected across the antenna and ground terminals on the instrument. A substitute for such a gap can be provided in the form of a burnt out flashlight bulb screwed into a miniature base, the terminals on the base being permanently connected to the antenna and ground terminals of the receiving set. The latter terminals are mounted close together a discharge gap may be provided by clamping two ordinary sewing needles in the terminals, separating the points by the thickness of a piece of paper. For maximum protection, however, complete disconnection of the receiving set from antenna and ground connections is advised.”

These suggestions are made for personal safety:

Don't attempt to operate the set while a local thunder shower is in progress. You can hear nothing but static discharges, the elimination of which is entirely beyond your control.

Don't touch the ground wire or the antenna lead wire while the storm is in progress.

If you use a lightning switch don't touch it while the storm is in progress, even though it may not be set in the grounded position.

Fire Department to Install Radio

Fire Commissioner Drennan of New York City has given his official sanction to the installation of radio receiving apparatus in the fire houses of the New York department, subject to regulations.

A number of the fire houses have judiciously had receiving apparatus which the men had purchased and installed that there has been some division of opinion as to the property of such equipment on city owned property without official approval.

In his approving statement Commissioner Drennan points out that radio will furnish diversion and healthy recreation for the firemen and help to relieve the monotony of engine-house life.

Apparatus may be installed at the expense of the firemen themselves, after written applications containing a sketch of the plan of the proposed installation have been approved by the chief of the Bureau of Fire Alarm Telegraph, Mr. Val Fenchrich, and also by the Department of Water Supply, Gas and Electricity, which has jurisdiction over all electrical appliances in public buildings.

No broadcasting or transmitting sets will be allowed in the fire houses.

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(Concluded from page 296)

niently organized as a committee of International Cham-
ber of Commerce established in 1920 after the Congress called
Atlantic City in October, 1919. The main function of this
organization should be to coordinate the work of the various
aeronautical Chambers of Commerce, aero clubs and similar
organizations throughout the world.

The constructive work which could be accomplished by both
the international organ of coordination of aeronautical Cham-
bers of Commerce, aero clubs and other aeronautical organiza-
tions is simply invaluable. All matter pertaining to interna-
tional regulation of flight, standardization, licensing of pilots,
testing of aircraft, wireless and meteorological services, organi-
zation of airdromes and airways, rules for complying with
customs and passport regulations, transshipment of mail, pas-
sengers and merchandise, could be thoroughly investigated by
specialists and satisfactorily settled. These two organizations
could be of tremendous help to the various governments in
suggesting the right kind of legislation needed to promote and
further the development of aeronautics all over the world.
In the meantime, while we have not any such organization it
is up to our aeronautical Chamber of Commerce and to the
Aero-Club of America to do whatever they can in order to en-
courage commercial aviation developments in this country, to
keep us closely in touch with the aeronautical situation all over
the world and to cooperate to the best of their ability with
similar organizations in Europe for promoting a true spirit of
international cooperation between aeronautical interests in the
world on matters of common interest, this being the condition
se qua non for succeeding in putting aeronautics on the map
of the world as a practical and safe international means of
transportation.

However, more than anything else, what we need at the
present time is to get started, to stop discussing projects with-
out regard to commercial aviation developments, and to actually
do something. As I said before, the logical start is the in-
stitution of a regular service for the transportation of mail
and merchandise between New York and Chicago, with the
right flying equipment bought in the United States at the right
price from aircraft manufacturers having sufficient faith in the
quality of their aircraft to be willing to become stockholders in
the company operating them. After this company has been
started right, let all the financial groups interested in com-



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mediate recognition and success.

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mercial aviation developments in this country concentrate their
efforts in building it up and making it the corner stone of our
commercial aviation activities.

Let us not have competition in the beginning of this game—
there will be plenty of opportunities for promoting develop-
ments in the future through competition. What we need for
the first year or two is cooperation: cooperation between finan-
cial interests in creating first a strong aerial operating com-
pany; the cooperation of the government, express companies
and the public at large in patronizing this new means of trans-
portation; the cooperation of aircraft manufacturers in provid-
ing good aeroplanes; the cooperation of the communities in
providing landing fields; and the cooperation of Congress in
enacting without any further delay the right kind of air legis-
lation.

If the first aerial transport company is able to start operating
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Assembled with Hartshorn Universal Strap Ends make
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Everything for Canuck, JN4D, J-1 Standard and OX5 Motor; New Wings \$90; landing gear complete \$75; radiator \$20; wing strut with fittings \$5; good center section with fittings \$17.50; Wing cover Canuck or JN4D, linen upper \$20; cotton upper \$15; Canuck Wing cover lower, linen or cotton \$14; Main Wing Beam \$8; Grade A Mercerized cotton 40c yd.; cotton tape 8c yd.; Grade AA linen 90c yd.; linen tape 8c; new 26x4 Goodyear Cord Tires \$7.50; slightly used \$3.75; reasonably used, excellent condition \$1.75; new tube \$1.50; Guaranteed Nitrate Dope \$2.50 per gal.; 5 gal. can \$10; \$75 per Barrel; acetate Dope, \$50 per barrel; Valspar Varnish \$6.50 per gal.; OAF spar varnish \$3.25 per gal.; Leather Helmets \$6. NAK Resistal Goggles \$6.75; CAL Propeller for OX5 \$15; Buffalo mahogany metal tipped \$35; Floortorp metal tipped latest design \$47.50; Floortorp metal tipped regular \$30; Compass (used) \$10; Tachometer Head \$7.50; oil gauges \$3.50; thermometer \$8. Climb and banking indicator combined \$12.50; recording barograph \$20; altimeters \$10.

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HELLER FLYING FIELD

NEWARK, N. J.

AERIAL AGE

WEEKLY

5, No. 14

JUNE 12, 1922

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IN WASHINGTON, D. C.

JUNE 15 and 29, 1922

At 3 P. M. (Eastern Time)

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40 engines, Curtiss OX-5, new.
215 " " " " used.

Bids opened June 15th.

At Little Rock, Ark., Air Reserve Depot—

2542 engines, Curtiss OX-5, new
568 " " " " used.

Bids opened June 29.

Bids will be accepted on all or any part of the equipment offered and no special form of bid is required. The Government reserves the right to reject any or all bids. For complete information regarding these offerings, and in transmitting bids, address:

**CHIEF, MATERIAL, DISPOSAL & SALVAGE
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WAR DEPARTMENT

June 12, 1922



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ECONOMY
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UP
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With which *Flying* is consolidated

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No. 14

Sea and Air Power

MR. ARCHIBALD HURD states the case in the manner of a partisan when he says in an article upon sea power and air power in *The Fortnightly Review* that "this country (England) is being challenged to prepare to confront entirely novel conditions of life; the ship of commerce, like the ship of war, is to disappear, and we are to receive the greater part of our food as well as the raw materials for our factories by aeroplane or airship, and we to conduct our export trade by the same means." That going too far in reflecting the opinions of the aircraft advocates. Mr. Hurd is as little disposed as the Admiralty to accept the view of Sir Percy Scott that the battleship is passing into the obsolete class. He speaks with scorn of the retired naval officers "who have little or no personal experience of war and even less of commerce who have been throwing up their hats in enthusiastic support of this conception of an island country without ships of war or ships of commerce." Admiral Sir Percy Scott, by the way, is a retired naval officer, but during the war he put London in a state of defense against aircraft attack with little, if any, actual help from the Admiralty. In a normal year Great Britain imports and exports 150,000,000 tons of goods and products. Certainly Sir Percy Scott and other believers in aircraft do not hold that Great Britain can dispense with surface ships in her ocean-borne trade. Mr. Hurd argues merely, as well as intemperately, when he says:

"There are nearly 4,000 large unarmed and, for the most part, slow merchant ships under the British flag. Is it imagined that an enemy desiring to strike this country a vital blow would devote attention to the few swift and powerfully armed men-of-war, when so many more desirable targets, the shape of merchant ships and their cargoes, were presented to attack?"

In the first place, this is to assume that international law will never again be observed in warfare; and in the second place, it is to lose sight of the fact that Great Britain already possesses a strong aircraft arm for offense and defense, and will continually add to it. Should an enemy copy in the methods of warfare the Germans practiced under the sea, Great Britain would be well prepared. She is giving a great deal of attention to the development of aircraft.

We are told that "it is today the considered opinion both of the Naval Staff and the Board of Admiralty that defense against aircraft, so far as capital ships are concerned, is, and

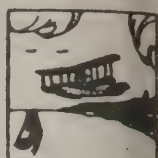
will keep, fully abreast of attack, whether by aircraft or submarines." But the Admiralty is far from infallible. When the war with Germany came it underestimated the potentialities of the submarine; it had little faith in the aeroplane as a fleet auxiliary; it was satisfied with the construction of capital ships that proved defective at Jutland; the shells used were not as damaging as the enemy's, and the machinery of gun elevation on the British fleet was not uniformly serviceable. Really the Admiralty is not a satisfactory authority upon defense against aircraft. Between the Admiralty and the Air Ministry there is a chronic feud.

Mr. Hurd summarizes the report of the Committee of Imperial Defense when he says: "It was held that in aircraft resided great possibilities of development, but that, in spite of the aeroplane, the airship and the submarine, the battleship, and therefore other types of men-of-war, remained practically unchallenged." "Practically unchallenged" is an unfortunate expression. Not only Sir Percy Scott but our own Admiral Sims maintains that the aeroplane successfully challenges the effectiveness of the surface warship.

It is true that the American Joint Army and Navy Board reported that "the battleship is still the backbone of the fleet and the bulwark of the nation's sea defense, and will so remain so long as the safe navigation of the sea for purposes of trade or transportation is vital to success in war." But at the same time the Joint Board also pronounced this judgment: "The aviation and ordnance experiments conducted with the ex-German vessels as targets have proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and Navy." Mr. Hurd is more impressed by the primacy given to the battleship than to the apprehension that the airship has alarming potentialities. None, however, but extremists who give free rein to their imaginations think that there can be a one-standard fleet operating only from the air, nor that surface cargo-carriers are obsolescent, soon to be succeeded by argosies of heavily freighted flying ships. As well maintain that railroad cars are to be scrapped, and the tracks torn up or abandoned to the elements. So long as the Seven Seas wash the shores of the world there will be ships of war and ships of commerce, and on land most of the carrying business will be done by the railroads and the motor car. Cost alone will limit the use of the airship in trade.—*Editorial in N. Y. Times.*



THE NEWS OF THE WEEK



Pulitzer Trophy Spurs Army Airmen

Dayton.—The United States Army Air Service will make a determined effort to win the Pulitzer Trophy in the international air race to be held at Detroit on September 15.

Announcement was made May 25 that orders had been placed for six special speed planes to be entered in this tournament. In addition, the Verville-Packard plane, winner of the 1920 classic, will be entered.

The contracts for the six speed planes were let to the Thomas Morse, Curtiss and Loening aeroplane manufacturing companies. Their construction will be rushed and they will be taken to Detroit on completion for final flight tests. Structural tests will be made at the different plants.

Major T. H. Bane, Commandant of the Engineering Division of the Army Air Service at McCook Field, said the provisions called for a guaranteed speed of approximately 200 miles an hour and what other equipment can be included in the construction to make the ships formidable contenders in the race. Contracts were drawn by the officers at McCook Field. The McCook Field entry has been undergoing a general overhauling, under the personal supervision of Alfred Verville, its designer. When this ship won the 1920 race it attained a speed of 186.7 miles an hour and was not operated at full speed. It was piloted by Lieut. C. C. Mosely of McCook Field.

Paris-London Aeroplane Falls Into Channel

A French aeroplane flying from the air station at Croydon, near London, bound for Paris, fell into the English Channel June 3. The pilot and two passengers were drowned. A cross Channel boat picked up two bodies. The accident occurred three miles from the English coast. It was observed from a Channel boat crowded with Whitsuntide holiday makers, which proceeded to a spot where the aeroplane fell.

The passengers were Gordon Ley, an Englishman, and Paul Carroll, a Paris business man. The British machine on which the two passengers had booked for the flight to Paris was not ready when they arrived at the Croydon airdrome this morning and they therefore were transferred to the French machine. Carroll's brother refused to make the flight.

Tennessee National Guard Squadron Gets Into Action

"All things come to him who waits" fittingly describes the 136th Squadron, Observation, Tennessee National Guard, which was Federally recognized in December, 1921. For many weeks the squadron "carried on" under very adverse conditions. Finally, a consignment of four JN6H's arrived, and immediate action was started to set them up the week following the completion of the first steel hangar. In the meantime the second hangar was completed, and the four H's have been set up, but lack of tools prevented the installation of motors.

Through the kindness of Major Roy S. Brown, a DH was loaned to the Regular Army Instructor, and on May 7th he flew it up to Nashville from Montgomery,

bringing the necessary tools. He was accompanied by a mechanic, Staff Sergeant Baehre, of the 22nd Squadron Observation. The plane was flown back on May 10th, and in the near future a DH will be permanently assigned to the Instructor.

Much difficulty has been experienced in obtaining equipment and supplies, due chiefly to lack of funds for freight and express charges. The transportation problem has been relieved through the kind and generous cooperation of the Commanding Officer at the Old Hickory (the former government powder plant), the Ordnance Depot, and the Tennessee State Highway Department.

The State has erected on the field an administration building, containing an office, orderly room, armament room, operations room, supply room, and a small medical clinic. Needless to say, it has been of great value since its completion.

On March 28, 1922, Lieutenant Vincent J. Meloy, Air Service, formerly commanding officer of the 8th Squadron (Attack), reported to the Adjutant General's Office, and shortly thereafter the squadron launched forth into its first training schedule. For the officers it consisted mainly of classes in Infantry Drill Regulations, Field Service Regulations, Manual of Courts Martial and some practical work with the D-R system of signalling. The enlisted personnel were given lengthy periods on the school of the soldier, squad and company, and practical work on rigging and motors.

The field is situated on the Lebanon Pike, adjoining the Hermitage, the home of Andrew Jackson. It is about 12 miles northeast of Nashville and about two miles south of Old Hickory. The hangars and administration building border the south side of the field, which is approximately 2200 feet square, with good approaches on all sides. A white circle, 50 feet in diameter, marks the center of the field.

Much credit is due Major J. C. Bennett, Jr., Air Service, Tennessee National Guard, the officers and enlisted men of the squadron, Major Baxter Sweeney, former Adjutant General, and Brigadier General P. I. Brumit, the present Adjutant General, for their perseverance, hard work and untiring efforts in getting the 136th under way. A word of praise is also due the Nashville Commercial Club for their efforts in behalf of the squadron.

World Flyers' Plane Smashed at Marseilles

Marseilles.—Major W. T. Blake was compelled to make a forced landing at Borely Park, just outside Marseilles, May 28, while on a flight from Lyons to Turin, Italy, in the continuation of his attempt to fly around the world.

The machine struck on rough ground, damaging the running gear and smashing the propeller. It is being towed to the Miramis aviation field for repairs and the flight probably will be delayed for several days. Neither Major Blake nor his companions, Broome and MacMillan, was injured.

Air Bomber Hits Target Three Times at 3,000 Ft.

Lieutenant Victor E. Bertrandas hit the Rock-and-Rye at an altitude of 3,000 feet

three times running May 30, in a demonstration of aeroplane bombing at Mitchel Field, Long Island. He was not unduly elated when he descended, however, Rock-and-Rye was the name given to warship model of wood and canvas, twenty-five feet long, which served as a target. At 2,500 feet Lieutenant Bertrandas missed the Rock-and-Rye by 100 feet. He mounted to the 3,000-foot level and dropped five more bombs, the first three of which landed fairly on the target, which burst into flames. A brisk wind was blowing at the time. Lieutenant L. V. Bea was pilot.

There was a ten-mile relay race at the army held also, in which each contestant used two aeroplanes and made the trip from the first to the second in a wheelbarrow. Lieutenant F. C. Fishback won. Captain I. S. Eaker won another ten-mile aeroplane race.

Plane Wins 105-Mile Race Against Stork

Norfolk, Va.—An aeroplane, fitted out like an ambulance, won a race with the stork May 30. It was a 105-mile race. The patient was landed safely at the door of the Public Health Hospital in this city and at last reports was doing well.

Mrs. W. N. Wilds, wife of a coast guard at Chicomico, N. C., was the patient. She stood the air trip well and was attended by the doctors during the entire flight.

Urgent calls for a doctor were sent out from the Hatteras radio station to the coast guard division headquarters today. No doctor for Mrs. Wilds could be procured in the little coast guard settlement at Hatteras.

Captain D. F. A. Deote, coast guard division commander here, ordered a plane and doctor from the naval base. Dr. Engle was routed from bed and the plane, one of the fastest at the base, departed for the coast guard station. The stork was expected this morning and the local doctor, who had promised to come, telegraphed from twenty miles away that impassable roads would keep him from arriving at Mrs. Wilds's bedside.

Aero Club of El Paso

Unusual interest is being displayed by former officers of the Air Service in the organization of the Air Service of the 90th Division Organized Reserves of which El Paso is the headquarters.

For some few months the former army air service men have been getting together at a weekly noon luncheon as well as other get-togethers for the purpose of bringing out the "T."

Just recently Lieut. Morris has been assigned to El Paso for the purpose of organizing the air service reserves and a most without exception the men have signed up for reserve commissions.

Not a small amount of flying talent represented by our club. We have many overseas men and three of our members were members of that famous Kosciuszko squadron which was so effective with the Polish army against the Bolsheviks. These men are Earl F. Evans, E. V. Chess and Bob Slaughter.

The AIRCRAFT TRADE REVIEW

Rickenbacker on 15,000-Mile Air Tour

Just as we go to press announcement is made of what is termed the longest flying venture ever planned from Mitchel Field, near Garden City, L. I., when Edward V. Rickenbacker, during the war America's premier ace and at present an official of the Rickenbacker Motor Company, and three companions will set out on an aerial industrial survey of the United States. In three months of constant travel over almost every State in the Union, Rickenbacker will stop at sixty-six of the more important cities of the nation.

On the completion of the flight, which is scheduled to end in Detroit, Mich., about September 1, Mr. Rickenbacker will forward to Major General Mason Patrick, Chief of the United States Air Service, a report on aeronautical conditions viewed from the angle of reserve national defense throughout the country. This report will be supplemented with information regarding emergency and permanent landing fields, meteorological conditions and the status of public interest in flying.

Mr. Rickenbacker said he had accepted invitations to address various organizations in aviation in cities where stops are to be made. He estimated it would be necessary to travel eight months by rail and motor to accomplish the survey he contemplated completing in three months.

"We can do a month's traveling in less than a week by plane," he said. "We plan to spend every night in a hotel instead of sleeping along over the rails in a Pullman berth. The information we will seek has long been needed."

Accompanying Mr. Rickenbacker will be Edward Stinson and Lloyd Bertaud, two of the leading flyers of this country, and Sve Hannigan, a writer, who will act as chronicler of the trip. The first leg of the flight will be from New York to Detroit, where the party will stop over night and "hop" to Chicago on Wednesday. The flyers will travel in a Junker all-metal monoplaner equipped with a 185-horsepower Hirth motor. The passenger cabin is entirely enclosed and fitted with electric lights and other conveniences.

In connection with the proposed trip of Rickenbacker the Aeronautical Chamber of Commerce yesterday gave out a statement based on a report submitted to the Secretary of Commerce that 3,000,000 miles in cross-country flights without a fatality was the safety record of aviation in this country for 1921.

In signed statements, 125 operators in all parts of the United States having an equipment of 600 planes showed that in twelve months they had made 130,736 flights, carrying 122,512 passengers 2,907,245 miles. Including the flights made by "gypsy" pilots the Aeronautical Chamber of Commerce figured the number of miles flown at 3,000,000.

Aerial Advertising

A novel newspaper advertising stunt has been attracting London crowds and giving them the aviation neck as they watched an aeroplane high in the sky write with a spray of white smoke the letters "Daily Mail." The stunt was first tried on Derby

day when betting on the big race was active.

The machine was easily 10,000 feet in the air, where there was no wind. When the word "Daily" had been written and the aviator was maneuvering to begin a new word the bookies asked what odds people would lay as to which one of half a dozen newspapers would be named. The smoke hung against the blue background and the letters were distinct for some time. The plane, carried a smoke generator and powerful ejector, which forced jets of smoke in the trail of the machine as it climbed up and down in the air. It was estimated the space occupied by "Daily Mail" in the sky was more than three miles wide.

The Decay of a Simple Eddy

This report (No. 144) by H. Bateman of the National Advisory Committee for Aeronautics, deals with a generalization of Taylor's formula for a simple eddy. The discussion of the properties of the eddy indicates that there is a slight analogy between the theory of eddies in a viscous fluid and the quantum theory of radiation. Another exact solution of the equations of motion of a viscous fluid yields a result which reminds one of the well-known condition for instability in the case of a horizontally stratified atmosphere.

A copy of Report No. 144 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Prest's Plane Damaged

Cheyenne.—C. O. Prest, aviator, attempting to fly from Buffalo to Siberia, was unable to continue his flight from this city May 29 because of damage done to the wings of his airplane by a hailstorm the day before.

Carlstrom Field to Be Closed

Tampa, Fla.—Uncle Sam has finally decided to abandon the Carlstrom aviation field at Arcadia, Fla., as soon as the cadet class, which is now in training there, is graduated, it has just been announced by

Maj.-Gen. M. M. Patrick, chief of the army air service, who has completed an inspection of the field.

An announcement that the war department would transfer the field's training activities to a Texas camp was made some time ago, but vigorous protests from all parts of Florida arose and the matter was given more thorough consideration.

General Patrick stated that there was no fault to be found with the flying conditions at Carlstrom and that the field had done a great work for the army, but it is a part of the pressure of economy to close numbers of aviation fields. The fields which are to be retained, most of them being in Texas, are equipped with greater housing facilities than is Carlstrom. The date of abandonment has been set for some time in June.

COMING AERONAUTICAL EVENTS

AMERICAN

Sept. 4.—Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)

Sept. 15.—Detroit Aerial Derby, (about) Detroit. (Pulitzer Trophy Race.)

Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

Aug. 1.—Coupe Jacques Schneider. (about) (Seaplane speed race.) Italy, probably Venice.

Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.

Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.



The Chamberlin-Standard 1-F3 Three Place Biplane

REGULATION OF AIR TRAFFIC

By DEVALUEZ*

CONSIDERING the progress of aerial navigation, the importance of uniform laws and the necessity of establishing certain principles and regulations intended to avoid controversies, and animated with the desire of aiding the development of international aerial communications for the purposes of peace, on October 13, 1919, the signatory governments of the peace treaty established a convention regulating aerial navigation.

The high contracting parties, while recognizing the complete and exclusive sovereignty of each power over the air space above its own territory, studied all cases susceptible of creating litigation between the different governments due to international aerial navigation and established laws accordingly.

With the observation of these laws, each government contracted to accord, in times of peace, to the aircraft of the other signatory powers of the convention, the liberty of inoffensive passage over its territory.

Without awaiting the signing of the protocol of this convention, most of the countries made special agreements with the countries to which they were joined by air routes and published special rules regulating the circulation of their aircraft over their own territory.

Thus France made agreements with Great Britain, Switzerland and Holland, and a decree was signed July 8, 1920, regulating aerial navigation in France. This decree, together with the bill subsequently submitted to the Senate, inspired the international convention and differed from the latter only in certain details.

It appears, therefore, that we can study concurrently the regulations for international aerial traffic established by the convention of October 13, 1919, and the French regulations established by the decree of July 8, 1920. These two sets of regulations supplement each other, the second being the practical application of the principles contained in the first.

The principal questions covered by the present legislation are as follows:

1. Conditions of safety which must be fulfilled by aircraft.
2. Licenses for members of the crew.
3. Traffic rules to be observed by French and foreign aircraft.

To these regulations there must be added those connected with the customs laws and the measures adopted by each country for its national defense.

Such are the broad lines of aerial regulation, which will be briefly expounded in the present article, some of these questions, moreover, needing to be the subjects of special communication.

Safety Requirements of Aircraft

Both international and French legislation require that no aircraft shall be operated without a certificate of navigability. This certificate, as defined by the French decree, is the attestation of the safety characteristics of the aircraft.

For the purpose of requiring guaranties as regards the safety characteristics of an aeroplane used for commercial purposes or for air travel, the French regulations impose a series of tests for new aircraft types and supervision of quantity production of aircraft.

The following procedure has been adopted and seems capable of giving all the necessary guaranties. The builder of a new type of aircraft must present his machine to the Technical Section of Aeronautics, which will subject it to static and flight tests. These tests will show whether the aircraft has a large enough factor of safety, and whether its characteristics and performances fulfill the requirements of the use for which it is designed.

After the tests have been made on the sample aircraft its quantity production is supervised by the Section of Aeronautic Construction, which makes sure that the aircraft thus produced is an exact copy of the sample, both in its characteristics and in the nature of the materials employed in its construction. In quantity production any aircraft that has undergone modifications susceptible of affecting its characteristics and performances must be subjected to the same tests as the original sample.

After the tests of a new type have been completed and adjudged satisfactory, its construction being under the control of competent parties, the aircraft may receive its certificate of navigability, and as soon as it is employed it comes under the control of the Aerial Navigation Section.

This section determines, at longer or shorter intervals, according to the use made of the aircraft, whether it continues to meet the safety requirements for holding the certificate of navigability. According to circumstances, the certificate is continued if the aircraft is in proper condition, or suspended if it is temporarily unavailable on account of undergoing repairs, permanently withdrawn, if it is unfit for further use.

An aircraft, on receiving its certificate of navigability, also receives its books, consisting of a route book, an aircraft book and an engine book. These books, which must be kept strictly up to date, render it possible to control the use of the aircraft, to comment on the routes followed and to keep track of incidents of navigation, accidents and repairs made.

Licenses

In order to take his place as an authorized member of the crew of a public aircraft for transportation or touring, any person performing the functions of pilot, navigator or mechanic must have a license or certificate. These certificates, which attest his physical and technical qualifications, comprise:

1. License as touring pilot, which does not confer the right to serve on a public aircraft, no matter in what manner he may be remunerated.

2. License as public transportation pilot, which gives him the right to carry passengers or freight for pay.

In each of these two classes (touring and public transportation) there is a special license for pilots of naval aeroplanes and seaplanes, by reason of special qualifications considered desirable for piloting such aircraft.

3. License as pilot of free balloon.

4. Three licenses (first, second and third class) as airship pilot. The holder of a license of the first class can command all kinds of airships. The holder of a second class license may command airships of less than 20,000 cubic meters gas capacity. A holder of a third class license may command airships of less than 6,000 cubic meters.

5. There are two aerial navigator licenses, elementary and superior. The presence of an elementary navigator is required by day on every public transportation aircraft making a trip of more than 200 and less than 500 km. over land, or a trip of less than 200 km. over water and such that the course, supposedly straight, does not carry the airship over 50 km. from the coast. By night the presence of an elementary navigator is required for every trip of less than 100 km. without leaving the country.

The presence of a navigator holding a superior license is required on any public transportation aircraft making voyage by day or night, above land or water for distances greater than those mentioned above.

6. Only one form of license for mechanics employed on public transportation aircraft.

Candidates for the various licenses must undergo practical tests and pass technical examinations in accordance with methodical plan and corresponding to the requirements of aerial tasks which they propose to perform. Military pilots who have kept in practice may be excused from the flight tests.

With the exception of the license of touring pilot, licenses are only granted candidates, after satisfactorily passing a medical examination before a special board of physicians.

All licenses must be renewed every six months. In order to have his license renewed, the holder must submit to another medical examination. If he is an aeroplane pilot he must show by the record of his aerial services during the previous six months that he has lost none of the professional qualities required for the issuance of his license.

The interval of time during which the holder of a license must not have interrupted his aerial services is six months for aeroplane pilots, two years for airship pilots and five years for navigators.

Traffic Rules for Aircraft Regulation

We have just seen that an aircraft cannot be certified for flying without answering certain rigid requirements and that similar precautions are taken with regard to the crew.

To these fundamental conditions, which are mostly for increasing the safety of aviation, there have just been added rules for preventing collisions in flight, especially over and the vicinity of airdromes.

The limits of this article do not allow us to explain in detail the measures adopted for this purpose. We will mention, however,

* From "Premier Congrès International de la Navigation Aérienne," Paris, November, 1921, Vol. I, pp. 165-170.

that these very complete regulations anticipate the maneuver to be made by aircraft crossing or passing one another landing or taking off simultaneously. They also provide flight in the vicinity of and above airdromes: the direction of flight must turn in response to signals and according to an established code; the interdiction of all acrobatic maneuvers; the division of the airdromes into landing and departing zones and a neutral zone.

These rules also prohibit flight over cities and towns, save at altitudes from which an aircraft can land outside the town, in case of failure of its means of propulsion.

For the purpose of being able to control the circulation of aircraft and identify them in case of infractions of traffic regulations, registration rules have been established. Every aircraft must be recorded in a special register and receive a registration certificate, on which are mentioned the distinguishing marks assigned to it, together with the name and address of its owner. The registration marks, which consist of a letter indicating nationality and a group of four letters, must be painted on the aircraft at designated locations and large enough to be clearly easily read by an observer on the ground.

Customs Regulations

In order to conform to customs laws, the following regulations have been adopted. Aircraft leaving the country can only depart from airdromes specially designated by the Customs Department of each country. Those coming from other countries must land on the same airdromes. Moreover, all aircraft coming from one country into another must cross the frontier at certain designated points.

The observation of these conditions enables the accomplishment of the customs formalities and the surveillance of the traffic of passage. Customs formalities on the designated airdromes comprise the verification of the freight, endorsement of manifest and route book and collection of customs duties.

Once landings outside customs airdromes are provided for, the commander of an aircraft, leaving a customs airdrome for a foreign country, lands before reaching the airdrome where he could accomplish the customs formalities, he must have his

(a) The part of France east of a line passing through the valley of the Moselle, the valley of the Moselle and the upper course of the Moselle as far as Switzerland.

(b) The six military ports of Cherbourg, Brest, Lorient, Rochefort, Toulon and Bizerte, as also Dunkerque, Nice, Villefranche and Bonifacio.

cargo verified by the nearest representative of the Customs Department. He may depart again only by authorization of this department, which, after verifying his books, designates the airdrome where the next landing is to be made for the purpose of paying the customs duties.

Safeguarding the National Defense

By the terms of the international convention the contracting countries having reserved the right to prohibit, for military reasons, flight over certain portions of their territory, each country has published special regulations on this subject.

France, who, by the decree of July 8, 1920, had anticipated the prohibition of flight over certain portions of her territory which she reserved the right to designate later, abrogated these dispositions by the decree of June 10, 1921.

Private French aircraft and the aircraft of countries with which France has made agreements are therefore authorized to fly over all parts of the country, on condition that they observe the air traffic regulations given above.

Flight over certain zones is, however, forbidden all aircraft carrying photograph or kinetograph cameras.* Special authorization may be accorded French citizens to use photograph cameras over the forbidden zones, but this privilege cannot be extended to foreigners.

Outside the prohibited zones, any French subject may use photograph cameras without special permission. The same privilege may be accorded foreigners, but only after a request has been addressed, by the parties interested, to the "Service de la Navigation Aérienne" (Department of Aerial Navigation), and after inquiry of the department concerned (Department of the Interior or of Foreign Affairs), according to whether the foreigner resides in France or not. Permits for the use of photograph cameras by strangers are temporary and their validity cannot exceed one month.

The above brief exposition of aerial regulations now in force does not pretend to be exhaustive, but only a summary of legislation which is entirely new and of recent application.

This legislation, in harmony with the present resources and needs of aerial navigation, cannot be considered final and must be modified in the future according to conditions.

It may be affirmed that safety must depend on the strict application of such regulations and without safety there can be no great development of aerial navigation.

(Translated by the National Advisory Committee for Aeronautics.)

THE LARSON TENSIONOMETER

In aeroplane construction the minimum weight which is consistent with safety is essential. This requires that the stresses in the parts of the structure are subjected be kept as low as possible. Some parts of the machine are subjected not only to the stresses imposed on them by the aerodynamic or vibratory load but also to internal stresses due to the tension in the main and drift wires. A certain amount of tension in these wires is necessary to maintain the alignment of the machine. Excessive tension will increase the initial stresses in the structure and thereby either reduce the factor of safety or require a heavier construction. Cases are on record in which improper adjustment in the drift wires resulted in the failure of wing members. Also when two or more wires are used to carry a load it is important to know that each receives its share of the tension. Some method of accurately determining the tension in a wire or cable is therefore desirable and it is for this purpose that the Larson Tensionometer has been designed.

The tensionometer consists essentially of a frame about 10 inches in length with two supports, a fixed distance apart, between which the wire may be adjusted. (See photograph.) Midway between these supports and operated by hand levers is a plunger which deflects the wire from its normal position. The operation of deflecting the wire compresses a calibrated spring. A load indicator, called the load dial, measures the compression of the spring, and this indicates the tension in the wire. A deflection dial indicates the deflection of the wire to the nearest 0.001 inch.

The theory upon which the instrument is based is simple. A wire, under tensile stress, is deflected from a straight line by a system of three concurrent forces, consisting of the tensions in the two segments of the wire on either side of the deflecting force and the lateral force, is formed. The system is in equilibrium and if the directions of all the forces and the magnitude of one are known the magnitude of the other two can be found. In the operation of the instrument the wire is deflected a prescribed amount, hence the angles between the forces

will be constant and the deflecting force will be proportional to the tension in the wire. The instrument is made direct reading by graduating the load dial so as to read the tension in the wire instead of the compression in the plunger spring. The sensitiveness of the instrument depends upon the sensitiveness of the load and deflection dials. Operating with a deflection of 0.1 inch, the deflection can be read directly to 0.001 inch, or 1 per cent. The load dial reads directly to the nearest 10 lbs.

To obtain the highest degree of accuracy on some of the larger sizes of wire the readings must be corrected for two reasons: (1) The tension in the wire is slightly increased when it is deflected from a straight line, (2) the wire offers a resistance to deflection because of its stiffness as a beam. Both of these tend to make the indicated load too large, but the corrections are of such a nature that they can be readily made when constant deflection is used.

The increase in stress due to deflecting the wire from a straight line depends upon the sectional area and the length of the wire, and upon the rigidity of the supports to which the wire is attached. Using the standard deflection, and assuming the supports to be rigid, it may be expressed by the formula

$$p = \frac{60,000}{L} A, \text{ in which } p \text{ is the increase in total load in pounds.}$$

A is the area of the wire in square inches and L is the length of the wire. It will be seen that this increase is small for conditions met in practice. Furthermore, this formula is based on the assumption that the ends are held in rigid supports. Any yielding of the structure to which the wire is attached will reduce the effect so that for aeroplane purposes this correction can generally be neglected.

The increase in the indicated load caused by the stiffness or beam action of the wire depends upon the amount of end restraint at the supports of the instrument and upon the section modulus of the wire. The end restraint depends upon the tensile

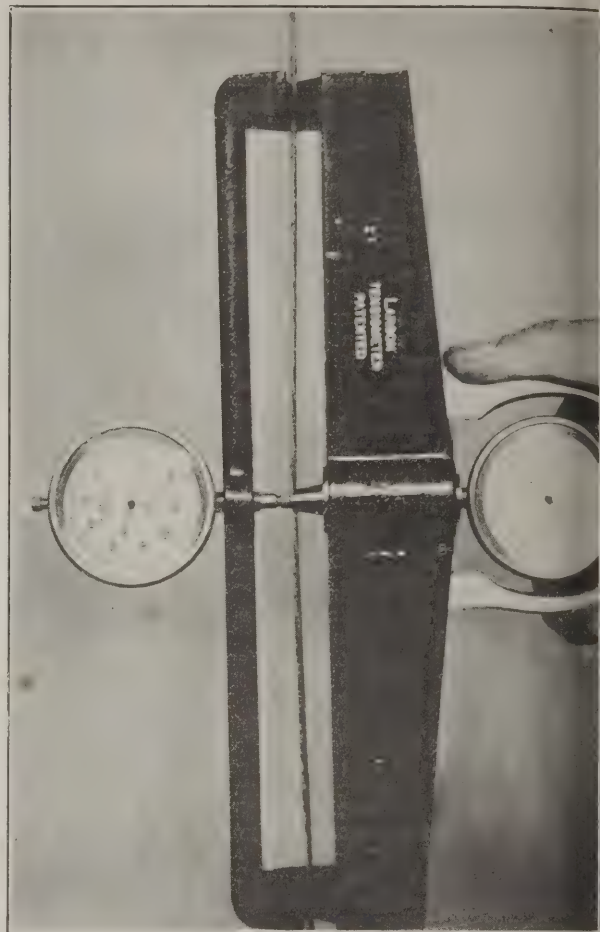
load on the wire. With no load the wire acts as a simple beam and as the tension on the wire increases the action approaches that of a fixed ended beam. The section modulus of the flexible cables is an uncertain factor, hence a theoretical consideration of this problem is impracticable. The only satisfactory method of determining the proper corrections is to calibrate the instrument on the various sizes of wire and cable upon which it is to be used. Calibration curves are available for most sizes of wire, both circular and streamline, and for all sizes of cable in use on aeroplanes.

As found from these curves the corrections for all cables up to $\frac{1}{8}$ inch are negligible. For cables from $\frac{5}{32}$ inch to $\frac{1}{4}$ inch and for all sizes of round solid wires the corrections vary with the size of cable or wire, but not with the tension in the wire for loads above 200 lbs. For cables above $\frac{1}{4}$ inch the corrections vary slightly with the load as well as with the diameter of the wire if the standard 10-inch instrument is used. A longer instrument on these large sizes of cable would materially reduce the corrections necessary.

Although corrections are required on a number of the sizes of wire and cable in use in aeroplanes the instruments can be made direct reading by setting the load dial for the correction of the size wire or cable upon which the observation is being made. The dial readings will then indicate the actual load on the wire near enough for all practical purposes. A plate giving the dial settings for the various sizes of wire is attached to the instrument.

The instruments have also been used in connection with sand loading test son planes and other research work. For such work in which greater accuracy is desired the calibration curves may be used to determine the load corresponding to any given reading.

In operation the instrument is never attached to the wire. It is simply placed in position, as shown in the photograph, and the hand levers brought together until the deflection dial makes one complete revolution (0.1). The reading on the load dial will then be the tension in the wire. When using the instrument on wires or cables for which corrections are required the load dial is adjusted by turning the face to the proper zero for the particular size of wire. The actual tension in the wire is then read on the load dial in the same manner as if no correction were needed. The time required to take a reading is only a few seconds, so that a complete set of readings on a plane may be taken in a very short time.



The Larson Tensiometer

PROPOSED AIR TRAFFIC LAW

By PROF. GEORGES RIPERT,

Of the Paris College of Law and the School of Political Science¹

SCIENTIFIC experiments and sporting activities have been followed by commercial exploitation. The important cities of Europe are connected by regular aerial navigation service. The "Indicateur Aerien" gives the time schedules, the transportation rates and the conditions for the acceptance of merchandise shipments. But when all these aircraft have left the ground, what law is going to control them, their crews and their passengers in this new domain which human intelligence has conquered?

Let us not imagine that, in overcoming the physical laws which seemed to hold him to the ground, man can thus easily evade juridical laws. The law of the country does not abandon him in these ethereal spaces, for every country has extended its frontiers to the sky and claims "complete and exclusive sovereignty over the atmospheric space above its territory."²

Moreover, the flights are of short duration and every time the aviator renews contact with the ground he returns to the juridical community which, for the moment, he may have thought he had left.

It is just because it cannot escape the law that aviation demands its due. It has today only an administrative set of regulations³ and the subsidies accorded by the government⁴. There is no aviation code of law.

¹ From "Premier Congrès International de la Navigation Aérienne," Paris, November, 1921, Vol. I, pp. 171-179.

This bill has been referred to the "Commission de la Société d'Etudes législatives" (Committee of the Society for Legislative Research), composed as follows: Mr. Fabry, counselor to the Court of Cassation, president; Messrs. Dufourmantelle, Imbrecq, Henri Fabry, Léon Jacob, Martin, Pierrot, Roland, Lumien, Talamon; Mr. Georges Ripert, chairman and Mr. René Capitant, secretary.

² International convention of October 13, 1919, for the regulation of aerial navigation, Art. 1: "The high contracting parties recognize that each power has complete and exclusive sovereignty over the atmospheric space above its own territory."

It is a curious fact, however, that international law has preceded the elaboration of internal law. An international convention signed October 13, 1919,⁵ by the representative 32 countries "animated with the desire to aid the development of international aerial communications for peace purposes established general rules relating to the nationality of air and to the admission of aircraft over foreign territory created an international air traffic commission.⁷ Annex the convention regulating air traffic in detail.

It would be very illogical, now there is an international convention, not to have an internal law. Hence, the government took the initiative on March 25, 1920, in introducing a bill

³ Decree of July 8, 1920, regulating air traffic in France (Journal officiel, July 13, Bulletin de la Navigation Aérienne, No. 7). Decree of Aug. 14, 1920, fixing the conditions for the issuance of aircraft gability certificates (Journal officiel, Aug. 14, Bulletin No. 6). Decree of April 14, 1920, establishing registration rules and the distinctive to be borne by aircraft (Journal officiel, Aug. 14, Bulletin No. 6). Decree of Aug. 26, 1920, regulating air traffic, beacons and signals (Journal officiel, Aug. 28, Bulletin No. 6). Decree of Sept. 18, 1920, relating to licenses of the navigating personnel of civil aeronautics (Journal officiel, Sept. 24, Bulletin No. 7). Decree of Sept. 30, 1920, establishing rules for keeping the books on aircraft (Journal officiel, Oct. 5, Bulletin No. 8). Decree of Jan. 12, 1921, establishing the customs rules to be observed by aircraft landing in or leaving France (Journal officiel, Jan. 18, Bulletin No. 11). Decree of June 10, 1921, regulating the transportation and use of photograph and cinematograph cameras on aircraft (Decree of June 10, 1921, repealing previous regulations relating to hidden zones).

⁴ Budget of April 30, 1921, Art. 88.

⁵ The law of Jan. 29, 1921, authorized the ratification of the convention. It was completed by an additional protocol May 1, 1920, which was signed July 15, 1921.

⁶ Preamble of the convention.

⁷ This commission was placed under the authority of the Society of Nations (Art. 34).

ffic.⁶ It amended this bill by a second, designed to be operated in the first. This bill has been examined by the session, but I cannot say that it was a satisfactory guide, it was both incomplete and disconnected. Though rich in regulations, it is very incomplete in the civil code of n. It would appear to threaten more than encourage.⁷ On the other hand, inspired by previous decrees, it has maintained the general progress of police regulation. This bill was, however, voted by the chamber of deputies on the recommendation of Mr. Bazire, in July, 1921. Foreign legislation does not offer any satisfactory model.⁸ In most countries, the rules are simple administrative measures relating to air and chiefly copies of the measures of the international convention. The decree of the Swiss federal council of January 1920, however, contains certain remarkable provisions, therefore necessary to draw up (without the authority of the convention nor the example of a foreign law) a law suited to the new form of commercial exploitation. This is all the more difficult, because a good law must not only satisfy the requirements of the time, but also make suitable provision for the future development of aviation. When we search in the whole world for laws which may serve us as a basis, we are immediately led to think of maritime law.

These words themselves suggest the comparison. The vehicle is called aircraft and its flights are called aerial navigation. These words are no misnomers. Like the ship, aircraft has an individuality and a nationality of its own. It carries with it a small colony of pilots and passengers. It occupies the territory of a small community. The one who is in command of it must have special rights and duties. He is not only a pilot, but also a chief. The aircraft, its crew, its passengers and freight run a common risk which may prove dangerous to them and others. All these conditions are the very ones which have created maritime laws.

There is, however, a difference, which cannot be disregarded. Sea and land are in some sort on the same plan and the ship never leaves its element. The aircraft flies above the ground and there are people and property on the ground. There are two juridical worlds superposed. On the one hand, an aircraft returns to the ground and there becomes an inert or rolling vehicle. Instead of comparing it with a ship, would it not therefore be fairer to liken it to an automobile and subject it to terrestrial laws, since, after flight, it returns to the ground to rest and renew its strength on the ground?

I do not think that such a conception could give aviation the law it requires. In my opinion, only a constant comparison with maritime law, with necessary modifications, can make it possible to state and solve the problems. Naturally, we must not be tempted to copy an aerial law from a maritime law, which has been elaborated by long centuries of work and which is essential for a perfect system of navigation. But there was a time when maritime voyages were only made along the coast and when boats were pulled up on dry land after their return to port. At that time the whole maritime law consisted of a few very simple rules. Such is the aircraft of today, which returns to earth after a short flight and such are the new aerial laws, taking into consideration the progress of aviation science. Soon aircraft will remain in the air for long periods of time and will make distant voyages. Then aerial laws will be improved and will presumably become more and more like maritime laws.

PART I.¹²

Aircraft

Chap. 1. General Provisions

Art. 1. The present law applies to all machines capable of sustaining themselves or circulating in the air (Pr. Art. 2).

The articles of this bill are referred to by the abbreviation Pr. ("proposition").

The original characteristic of this bill," writes Deputy Bazire in his report, "resides especially in its being a collection of penalties, which ensure the repression of law infringements."

Great Britain.—Law of March 1, 1919, which enabled the regulation of aircraft by decree.

Belgium.—Decree of Nov. 27, 1919, supplemented by a departmental decree adopting the regulations of the international convention.

France.—Decree of Nov. 27, 1919.

Spain.—Decree of Nov. 5, 1919, on air traffic; decree of April 27, 1920, relating to pilots, observers and mechanics of the civil air service; decree of April 17, 1920, on foreign aviators in Spain; decree of April 1920, on registration of aircraft.

Switzerland.—Decree of the federal council, Jan. 27, 1920, on air traffic regulation in Switzerland.

Italy.—Decree of Sept. 7, 1920, on air traffic.

Russia.—Decree of March 15, 1920, on the regulation of aviation.

Is it not thus come under fluvial law? In countries where fluvial navigation is important (Belgium, Holland, Germany), river and canal transportations are governed by maritime law or rules based on this law.

The abbreviation "Pr." refers to the proposed law voted by the chamber of Deputies; "Conv." to the convention of October 13, 1919.

Art. 2. Military and government aircraft, exclusively assigned to public service, are only subject to the laws relating to the responsibility of the proprietor or the exploiter (Pr. Art. 2; Conv. Art. 30 and 31).

Art. 3. Every aircraft must be entered in a register, kept by the department in charge of the air service. It is distinguished by a name or number and by the designation of the class to which it belongs (Pr. Art. 3; Conv. Art. 10). A decree will designate the classes of aircraft which are not required to register (Pr. Art. 9).

Chap. 2. Nationality of Aircraft

Art. 4. An aircraft entered in the French register has the French nationality and must carry symbol of this nationality according to regulations (Pr. Art. 1 and 3; Conv. Art. 6 and 10).

Art. 5. No aircraft can be registered in France unless it belongs entirely to Frenchmen (Pr. Art. 2; Conv. 7, par. 1).

Only French companies can be registered as the proprietors of aircraft. Moreover, in partnerships, all the persons associated by name and all silent partners and, in stock companies, the president of the administrative council, the manager and at least two-thirds of the directors must be French (Pr. Art. 3; Conv. Art. 7, par. 2).

Art. 6. An aircraft registered in France loses its French nationality if the conditions of Art. 5 are not fulfilled or if its proprietor has it registered in a foreign country (Pr. Art. 3).

Art. 7. Any aircraft registered in a foreign country can be entered in the French register only after the erasure of its entry on the foreign register (Pr. Art. 3; Conv. Art. 8 and 9).

Art. 8. Aircraft of foreign nationality cannot fly over French territory unless the right is accorded them by a diplomatic convention or if they receive authorization, which must be special and temporary (Pr. Art. 1; Conv. Art. 5).

Art. 9. The commercial transportation of passengers and freight between different points on French territory and between France and the French colonies is reserved to French aircraft, with the privilege of according special and temporary concessions by decree (Conv. Art. 16 and 17).

Art. 10. The juridical relations between passengers on a foreign aircraft in flight are governed by the law of the country of the aircraft, whenever such law is normally competent.

However, in the case of a crime committed on a foreign aircraft, French courts are competent, if the author or the victim is of French nationality, or if the aircraft lands in France after the commission of the crime (Conv. Art. 32 and 33).

Chap. 3. Ownership and Mortgaging of Aircraft

Art. 11. The register gives the name and address of the owner of the aircraft, the type of machine and its name or number.

Art. 12. Aircraft are personal property for the application of the laws of the civil code, but the cession of property must be confirmed in writing and only affects third parties by being entered in the register.

Every property transfer, by decrease or otherwise, must be recorded in the register at the request of the new proprietor.

Art. 13. Registrations are public property and any one may obtain a certified copy.

Art. 14. Aircraft may be mortgaged. The mortgage is recorded in the register. The law of July 5, 1917, on fluvial mortgages has been declared applicable to aircraft mortgages, the official who keeps the register being substituted for the registrar of the tribunal of commerce for this purpose.

Chap. 4. Seizure and Sale

Art. 15. The seizure and forced sale of an aircraft are made as provided by the law of July 5, 1917, on the registration and mortgaging of river boats, and the record of the proceedings is always entered in the register.

Art. 16. In case of seizure for infringement of a patent, the proprietor of the foreign aircraft, or his representative, may obtain a release on depositing a bond, the amount of which, in default of mutual agreement, is fixed with the least possible delay by the justice of the place of the place of seizure (Pr. Art. 16; Conv. Art. 18).

Art. 17. When the proprietor of the aircraft is not domiciled in France, or when the aircraft is of foreign nationality, any creditor has the right to make a seizure with the authorization of the justice of the peace of the canton where the aircraft has landed. The judge may grant a withdrawal of the seizure, if the proprietor offers to deposit a bond equal to the amount of the indebtedness claimed, and he can order such withdrawal, on fixing the amount of the bond, in case of dispute over the amount of the debt (Pr. Art. 39).

Art. 18. The public authorities have the right to seize any French or foreign aircraft which does not fulfill the conditions provided by law, or of which the pilot has committed an infraction.

An aircraft can be confiscated only in cases provided by law (Pr. Art. 39).

PART II.

Air Traffic

Chap. 1. Right of Circulation

Art. 19. Aircraft may circulate freely above French territory, excepting for the reservations of Art. 8 (Conv. Art. 5).

However, the right for an aircraft to fly over property cannot be exercised under conditions such as to interfere with the rights of the proprietor.

Art. 20. Flight over certain portions of French territory may be prohibited by decree for military reasons. The location and extent of the forbidden zones must be definitely indicated by the decree.

Any aircraft which enters a forbidden zone is required, as soon as it becomes aware of the fact, to give the proper signal and land on the nearest airdrome outside the forbidden zone (Pr. Art. 10; Conv. Art. 3 and 4).

Art. 21. An aircraft may fly over a city or town only at such an altitude that it would always be possible to land outside the city or town or on a public airdrome, even if the engine should stop (Pr. Art. 20).

Art. 22. All acrobatic stunts, consisting of perilous and useless evolutions, are forbidden above cities or the part of an airdrome open to the public (Pr. Art. 20, par. 2).

Art. 23. Evolutions of aircraft for public exhibition can occur only with permission of the chief of police after consultation with the mayor.

If the test consists of a trip including several successive landings, the permission is given by the Minister of the Interior (Pr. Art. 19).

Chap. 2. Landing and Airdromes

Art. 24. Except in cases of urgent necessity, aircraft must land only on airdromes open to the public (Pr. Art. 4; Conv. Art. 24).

Art. 25. In case of landing on private property, the owner of the land cannot oppose the departure or removal of an aircraft the seizure of which has not been ordered.

Art. 26. An airdrome is any field specially prepared for the departure and landing of aircraft and designed to serve air traffic either in public or private capacity.

Art. 27. Public airdromes are created by the central government, the "departments" (counties) or the "communes" (townships).

Departmental or communal airdromes can only be established with the authorization of the minister in charge of the air service and they are subject to the surveillance of government agents (Pr. Art. 4; Conv. Art. 24).

Art. 28. Fields to be acquired for the establishment of public airdromes may be the object of a declaration of public utility by decrees rendered in the form of public administrative regulations (Pr. Art. 41).

Art. 29. An airdrome may be established by the owner of the field only by administrative permission.

The permit may specify that the airdrome must be open to all aircraft, in which case it will fix the rent to be paid the owner of the land. The permit may be withdrawn, if the conditions are not observed (Pr. Art. 4).

Art. 30. Aircraft which cover international routes must take off from and land on special airdromes, termed frontier airdromes. In crossing the frontier, they must follow a route determined by the administrative authority (Pr. Art. 14; Conv. Art. 15, par. 2).

Certain types of aircraft may, by reason of the nature of their work, be excused from landing on the frontier airdromes. The permit designates, in this case, the airdrome of arrival and departure, the route to be followed and the signals to be given on passing the frontier.

Chap. 3. Air Traffic Police

Art. 31. The commander, pilots, mechanics, and all other persons connected with the operation of an aircraft must have licenses under conditions determined by ministerial decree.

Licenses of commanders and pilots of French aircraft making international trips can only be granted to Frenchmen (Pr. Art. 8; Conv. Art. 12 and 13).

Art. 32. No aircraft can engage in air traffic unless it has been registered and is provided with a navigability certificate, issue after inspection of the machine, under conditions determined by ministerial decree.

The decree will further determine the pieces to be carried on the aircraft and the marks to be painted on it (Pr. Art. 6, 7 and 9; Conv. Art. 11, 19 and 20).

Art. 33. Without special authorization, aircraft are forbidden to carry explosives, arms and war munitions, homing pigeons and objects of correspondence comprised in the postal monopoly.

Transportation and use of photograph cameras may be forbidden by ministerial decree (Pr. Art. 11; Conv. Art. 29).

Art. 34. No radio instrument can be installed on an aircraft without special permission.

Aircraft assigned to a public passenger transportation company must be provided with radio instruments under conditions to be fixed by decree.

In every instance, men assigned to radio service must be provided with special licenses (Pr. Art. 12; Conv. Art. 14).

Art. 35. Every aircraft, landing on an airdrome, is subject to inspection and surveillance by the administrative authority (Pr. Art. 13; Conv. Art. 21).

Art. 36. Every aircraft in circulation, wherever it may be, must submit to the orders of the post office department and the police and customs aircraft, under whatever form the orders may be given (Pr. Art. 13; Conv. Art. 15, par. 1).

Art. 37. Aircraft flying exclusively over airdromes and regions assigned by administrative authorities as experimental are not subject to the conditions required by law for traffic.

They cannot, however, carry passengers, unless provided with navigability certificates (Pr. Art. 21).

Art. 38. Certificates of navigability and licenses, issued by the government whose nationality the aircraft possesses, are honored for flight above French territory, if the equivalent has been allowed by international convention or by decree.

PART III.

Air Traffic

Chap. 1. Transportation of Merchandise

Art. 39. A contract for carrying freight is confirmed by way-bill or receipt. This document must contain, in addition to the stipulations of Art. 102 of the "Code de Commerce," a statement that the shipment is to go by air.

Art. 40. The carrier must fill out a manifest, designating the nature of the merchandise carried. A duplicate of the manifest must be carried on the aircraft and must be shown on demand to agents of the traffic police and to customs agents.

Art. 41. The carrier is responsible for loss or damage to goods carried, aside from acts of Providence or defect inherent in the goods.

If, however, the value of the goods is not declared by the shipper, the responsibility of the carrier is limited to 100 francs for each package.

Art. 42. The carrier may, by special clause, free himself from the responsibility otherwise devolving on him by reason of the risks of the air and of errors committed by the crew.

This clause relieves the carrier of responsibility on condition that the aircraft is in good navigable condition at the time of starting. The administrative certificate carries a presumption of navigability, which may, however, be overthrown by the contrary.

Art. 43. All clauses are null, whose object is to relieve the carrier of responsibility for himself or his subordinates in loading, storing and delivering goods.

Art. 44. The commander has the right to have the merchandise thrown overboard during the trip if it is necessary for the safety of the aircraft. If a choice is possible, he must throw overboard merchandise of small value. No responsibility devolves on the carrier, toward the shipper and addresser, for this loss.

Art. 45. With the preceding exceptions, the rules of the "Code de Commerce" relating to transportation by land and water apply to transportation by air.

Chap. 2. Passengers

Art. 46. The contract for carrying a passenger is confirmed by the issuance of a ticket.

A list is made of the names of the passengers, a duplicate of which must be kept on the aircraft and communicated on demand to agents of the traffic police.

This does not apply, however, to round non-stop flights to the airdrome of departure.

Art. 47. For international transportation, the carrier may only accept passengers, after making sure that they are lawfully authorized to land at the point of destination or intermediate stations.

Art. 48. The carrier may relieve himself of responsibility for accidents to the passengers in accordance with the provisions of Art. 42.

Chap. 3. Renting Aircraft

Art. 49. In case an aircraft is rented for several successive trips and for a given period of time, the commander, pilot and crew remain, except on agreement to the contrary, under the orders of the owner of the aircraft.

Art. 50. The owner of an aircraft let to a third party

ins subject to the legal requirements and is held responsible, together with the renter, for their violation. However, if the renting contract is recorded in the register and if the renter fulfills the required conditions for French aircraft, he is alone held responsible for fulfilling the legal obligations.

PART IV.

Responsibility for Damages

Art. 51. Pilots are expected to conform to the regulations with reference to the air traffic police, to the route, to the lights and signals and to take all necessary precautions for avoiding accidents.

Art. 52. In case of damage done by an aircraft in flight to another aircraft in flight, the responsibility of the pilots and the owner of the aircraft is regulated in conformity with the provisions of the civil code (Pr. Art. 5, par. 2).

Art. 53. The owner of an aircraft is responsible for damages caused by the evolutions of an aircraft, or by objects becoming detached from it, to persons or property on the ground.

This responsibility can be escaped only by proving the fault of the victim (Pr. Art. 5).

Art. 54. It is forbidden to throw from an aircraft in flight except for urgent reasons, any objects whatsoever, with the exception of the regular ballast (Pr. Art. 15, par. 2).

In case objects or the regular ballast, thrown out by necessity, cause injury to persons and property on the ground, the responsibility will be regulated in accordance with the provisions of the foregoing article (Suisse, Art. 22).

Art. 55. In the case of a rented aircraft, the owner and the renter are jointly responsible toward third parties for damages inflicted (Suisse, Art. 26).

However, if the renting is recorded in the register, the

owner is responsible, if the third party proves fault on his part.

Art. 56. The suit for damages may be brought, at the option of the plaintiff, either before the court of the town where the damage is done, or before the court of the town where the defendant resides.

If it is an injury done an aircraft in flight, the court of the place of injury is the one within the jurisdiction of which the victim is obliged to land after the injury (Suisse, Art. 32).

Art. 57. The law of April 29, 1916, on maritime assistance and salvage applies to aircraft in peril at sea and to the pilots of aircraft who can lend assistance to persons in peril (Pr. Art. 17 and 18; Conv. Art. 22 and 23).

Art. 58. Any one who finds the wreck of an aircraft must report it to the municipal authorities within 48 hours of its discovery. Any infraction of this requirement is subject to the penalties in Art. 475, par. 12, of the penal code (Pr. Art. 18).

The rules regarding maritime wrecks apply only to aircraft found on the sea or seacoast (Conv. Art. 23).

Art. 59. In case of the disappearance of an aircraft without news, it is considered lost three months after the date of the dispatch of the last news.

The death of the persons on an aircraft may, after the expiration of this period, be declared by the application of the law of January 8, 1893.

PART V.

Penalties

(Under this head, there will be inserted the penal provisions in the legislative bill drawn up by the government.)

(Translated by the National Advisory Committee for Aeronautics.)

AIR SERVICE IN COMBAT IN CONJUNCTION WITH OTHER ARMS

By MAJOR H. H. ARNOLD,

Corps Area Air Officer

(Speech Delivered at meeting of the Association of the Army of the United States, May 22, 1922).

IN delivering this talk today two thoughts primarily impress themselves on my mind. The first is that I was told by one of the officers of this organization that in order to make an acceptable address I had not only to talk as if I were convinced that the Air Service was the most important branch of the Army, but also to convince everyone else of the same thing; and, second, that there was probably no other branch of the Army so freely "cussed out" during the World War as was the Air Service. In order that you may obtain the background for a picture of Air Service in combat it is essential that I digress for a few minutes from that subject and outline in a very general way the fundamental preliminaries which must be gone through to properly prepare for an efficient all-around combat Air Service.

The structure around which any Air Service Unit is built is the Pilot. The success or failure of any mission, either in peace or war, in the Air Service depends upon the resourcefulness, stick-to-it-iveness, fearlessness and self-confidence of the Pilot. In selecting personnel suitable for pilot training there are certain fundamental qualities which if it is known that an individual possesses make him immediately eligible for training without question. These qualifications may be outlined as: initiative combined with daring; willingness to sacrifice for military good; confidence, capacity for sustained suspense; interest, and perfect health. During the World War the average life of a pilot on the front was about three months. At the end of that time he had either been shot down, injured in a crash behind our own lines, or had developed nerves to such an extent that he imagined moderate difficulties and obstacles as to make him unfit for further service. It is true that certain pilots last much longer than three months, but they are the exception rather than the rule.

The training of all Air Service personnel was conducted with a view of taking complete advantage of the qualities already obtained and utilizing to the fullest extent the short life of these men while they were on the front. Candidates for the Air Service were selected after having been given a thorough physical examination including a re-breather test. This test made it possible to determine at the start whether or not the candidates could control their entire physical and mental faculties at altitudes above 15,000 feet. Having been given this preliminary examination they were sent to a primary flying school where

they were taught the fundamentals of flying, and—from actual observation segregated into groups according to their personal qualifications. These groups were: The very best pilots—*Pursuit*; extremely reckless but good gunnery—*Ground Attack*; calm, mathematical and exceptional concentration—*Artillery Observation*; exceptional knowledge of maps, distances and map reading—*Photography*; exceptional vision, good in map reading and above average in gunnery—*Deep Reconnaissance*. The preliminary training of all pilots included fundamentals of radio, photography, attack, bombardment and gunnery. After they had been classified for special work they were given comprehensive courses in the subjects most necessary for their particular branch of flying.

The primary duty of any Air Service in battle is to clear the skies of all enemy air service,—this includes all hostile Lighter-than-Air and Heavier-than-air craft. The other duties, such as reconnaissance of artillery fire, bombardment and ground attack are all of secondary importance, for it is readily seen that if the enemy air service is permitted to observe for their own artillery, bombard masses of troops, supply stations, ammunition dumps, etc., photograph at will behind our lines and harass our own Infantry by ground attack, any work of a similar nature done by our own Air Service would be completely counterbalanced and no practical benefit would be derived therefrom. The statement so often made by officers and enlisted men in the other branches during the World War was that while they saw many German aeroplanes they seldom, if ever, saw any Allied planes in their section of the line. Further, apparently our own troops did not recognize our own planes when they saw them, for our own Infantry in the front lines quite frequently fired on Allied planes. It was, therefore, necessary, in order to keep our troops from firing at Allied aeroplanes, to post signs in conspicuous places where all troops could see them with the insignia used by our own Air Service on these signs, together with a request: "Do not shoot at aeroplanes using this insignia for they are your friends and are trying to help you." At about the time our own troops were making statements of never seeing Allied planes, the German troops were stating just the opposite. Shortly after the Armistice a German Artillery Officer was interviewed in Metz and he asked the question as to where the Allies secured all their aeroplanes, because while he was up on

the front he saw many Allied aeroplanes but seldom, if ever, saw a German aeroplane.

In figuring out a plan of operation which will preclude the crossing of our own lines by enemy aeroplanes it has always to be borne in mind that Air travel is entirely different from ground travel in that aircraft can operate in three dimensions. There are no set roads to follow; they move so rapidly that they are seen only for a short time before they are actually present; they can change their course at will, making it impossible, as a general rule, to anticipate their destination. It is obviously impossible to have a constant patrol of combat aeroplanes along the entire front so dense that it will prohibit the crossing of hostile planes,—for while the patrols are operating from the ground to altitudes of 3000 feet, enemy planes could get over at five, ten or fifteen thousand. The enormous number of planes to be used in such a patrol to make it absolutely impenetrable would be entirely too great for the benefits which would be derived therefrom. However, in order that protection against hostile aircraft raids can be given, the generally accepted plan of operations is to have patrols over certain areas carried out at intervals,—the remainder of the combat Air Service to be held in readiness at the aerodromes. The presence of hostile aircraft is made known by calls from the ground troops; by anti-aircraft fire; by report from balloons or by actual observation of the pursuit planes on patrol. After their location is actually determined by one of the above methods a concentration of our own combat planes is made with a view of driving them down or back across the lines. These hostile planes might be crossing the lines for the purpose of carrying out any one of several missions, such as observing for artillery; taking photographs, bombarding ammunition dumps, supply stations or masses of troops, or harassing the Infantry. In any one of these cases, however, the method of defense is the same. After the hostile planes are located our own pursuit planes converge on that sector in such a manner as to insure that enemy's mission will not be executed.

One of the most disagreeable tasks in connection with protection against hostile aircraft is night pursuit work. This requires pursuit planes to leave their aerodrome in the dark with a view of locating hostile bombardment planes which might or might not have been located by searchlights and drive them down before they execute their missions. In order to properly perform this duty these pilots must have absolute confidence in their planes and must not know the meaning of the word "fear", for after once leaving their own aerodromes they are entirely dependent upon the reliability of their engines. Emergency landing fields cannot be seen at night and the pilot's only salvation is in his being able to return to a friendly aerodrome and by giving the Very pistol signal already agreed upon have the landing lights turned on the field prior to his actual descent.

In actual combat in the air there are certain well-defined rules which must be carried out in order to insure success in an engagement. Every aeroplane has what is known as a "blind spot". This is caused by parts of the aeroplane masking the pilot's or observer's vision. There are certain other sections in which an object can be seen but cannot be fired upon from the aeroplane due to interference by parts of the plane itself. An experienced aviator knows as soon as a hostile aircraft is seen where the blind spots are and the best method of attack. In order to eliminate these blind spots patrols ordinarily fly in a "V" formation. This enables the blind spots of one aeroplane to be covered by the guns from the other planes, and as long as the formation is kept intact any attacking force will be under fire at all times. The tactics of the air, therefore, contemplate maneuvers so that the formation will be broken,—usually by the least experienced pilots who get nervous or panic-stricken. As soon as the formation is broken it is an easy matter for the experienced pilots to approach the individual planes either by a straight dive from above or by a zoom under the tail and secure several machine gun bursts on the plane before being seen. The melee which ensues after a formation is broken was commonly called during the World War a "dog fight". Many an inexperienced pilot lost his life on account of his leaving the formation through fear, becoming rattled or due to mechanical trouble with his plane.

One of the first things a pilot learns in combat is that if he gets between the sun and his opponents he can attack almost at will. Another favorite method of attack is to have a decoy of one lone plane cruising around below a mass of clouds, and when hostile planes picked on it as something easy a whole formation comes out from in back of the bank of clouds and converges on the assailants.

The most important function of the Air Service in conjunction with the other arms is the securing and transmitting of information concerning the developments in and beyond the line of battle. This work has been in the past rendered most difficult because the limitations and possibilities of the Air Service were not sufficiently well known to the staff or to the troops, and the unreliability of the radio. The work of keeping the

command informed is done by visual reconnaissance and reporting by radio, such as in artillery observation and by photographic missions. An aeroplane cannot stand still to observe and troops on the ground cannot be compelled, if they are hidden, to expose themselves; although in many instances a low flying aeroplane by circling over a point suspected to conceal hostile troops has made them reveal themselves either due to their curiosity or their fear of bombardment or being shot at. A reconnaissance mission may sometimes fail, due to weather conditions such as fog or low clouds. In this connection an incident which occurred in the Argonne is to be noted. One of our crack pilots took up a brand new Observer. As he was about to cross the line he noticed that the "Archies" opened with unusual intensity and that beyond the lines there was low bank of clouds. After very skillful dodging he penetrated the barrage of "Archies" and flew low through the clouds to his objective. The pilot saw conditions which made him anxious to return with the news,—so that after a very hazardous flight he returned over the waiting General who was to receive the report, and the Observer dropped the message. After landing at the airdrome the pilot asked the Observer: "What message did you drop?" The Observer replied: "I dropped him the message: Would liked to have gone over the lines and complete the mission but there were too many Archies."

To the experienced aerial observer certain things show up on the ground more or less clearly due to the background and shadows. Soldiers standing on the line where two fields meet are hard to see, while if they are a few feet away from the line they become readily visible. Wheel tracks and paths are easily noted. Freshly turned earth is very conspicuous and the amount of camouflage can completely conceal it. To locate troops on broken ground requires flying at altitudes of several hundred feet or less at which altitude aeroplanes are extremely vulnerable to machine gun fire from the ground. A mission which is often given to the Air Service is to locate the advance line of the Infantry. This mission is most difficult to perform as a general rule on account of the Infantry being too busy with their having no inclination to show their panels. Then, on the other hand, there is a certain fear that if they do show their panels they are locating their position to hostile aircraft. During the World War a certain Infantry Regiment on the front line was visited by an Air Service Officer, and when the commanding plane which was sent out to locate their front line had fired off the predetermined signals which established its identity the infantry battalion did not display its panels. The Air Service Officer asked why the panels were not displayed and he was told that they would not display their panels for any aeroplanes because as soon as they did a Bosch plane would see their panels and in a few minutes all the hardware in Germany would be rained upon them. However, the aeroplane can, with the co-operation of the front line Infantry, establish for the Commanding General the exact location of the front line troops more accurately than can be done in any other way.

Aerial photographs, if taken under proper conditions, will show the minutest details of the ground. In order to properly interpret them, however, considerable experience must be had in that line of work, otherwise data of the utmost importance will be seen but not appreciated. When the air is clear and there is no haze, the taking of aerial photographs is simple, but with unfavorable weather conditions and artificial hindrances such as smoke considerable difficulty is experienced in securing the results desired. When the Commanding General of troops desires information concerning the area back of the enemy lines he cannot wait for the clouds to clear or the smoke to blow away. To remedy these conditions certain improvements have been made on cameras which make it possible now to take fairly clear and distinct pictures in spite of haze and smoke. Under ideal conditions it is now possible for an aeroplane to leave the airdrome, fly fifty miles, take a photograph or a series of photographs, return with them to the airdrome, develop the film and print the pictures and have them in the hands of the staff requiring them,—all within one hour and forty minutes.

Artillery observation is most satisfactorily performed by aeroplanes making figure eights over the objective and sending in to the artillery command station the results of the firing by radio. That would be the ideal way of carrying it out provided the enemy did not have the habit of trying to drive the planes home while they were at work. For the shorter ranges the observation is performed by the captive balloons. These balloons ascend to altitudes of about 3000 feet and practically at nothing more or less than an elevated platform 3000 feet above the ground. From this point, by the use of field glasses, the can spot every shot fired and its relation to the target. As the range increases it becomes necessary to send artillery observation planes over to report on the results of the firing regardless of hostile interference. In some instances, provided the results expected warrant it, it may be necessary to use Pursuit planes to protect the Observation planes while they are on that mission; but ordinarily the observation planes must be self-sufficient.

ing. While the Observer is locating the shells which fall pilot must guide his ship so that the target is always under constant observation by the Observer and at the same time the t and observer both must keep on the lookout for the attack hostile planes. A few other special missions which observa- aeroplanes carry out are finding the enemy's lines; report- location of and relaying signals from our own front line ntry; repeating instructions to our advance lines; indicating re resistance to advance will be met; using at critical mo- ts the guns and bombs mounted on the aeroplanes against ts of resistance and verifying reports received which are ght to be of value.

he principal Air Service offensive operations against ground gets are bombardment and ground attack. Points most ally designated for bombardment objectives are; ammuni- dumps, railroad stations, cantonments or masses of troops, age areas within the fighting area, and manufacturing ts, railroad stations and large supply stations beyond the ing zone. Unless they are of such large size as warrant ial attention these objectives within the fighting zone are ally bombed by the day bombardment aeroplanes and re objectives beyond the fighting zone are usually bombed the night bombardment planes. The main difference be- en the day bombardment and the night bombardment planes e radius of action and load carried; whereas, the day bom- iment planes have a radius of action of about 300 miles, night bombardment planes have a radius of action of from e to eight hundred miles. The day bombardment planes can y a load of three or four hundred pounds of bombs and the it bombardment planes can carry a load of bombs up to two and pounds. The day bombardment planes are able to go the lines at an altitude of from eight to twelve thousand e, while the night bombardment planes go over the lines as o as fifteen hundred feet.

rdinarily the day bombardment planes rely on the "V" for- ion for their safety. In certain instances where enemy air- t are known to be in extra heavy force Pursuit planes are e along as a convoy until they have passed the front line of enemy's airdromes. In order to make their report complete y return to their home airdrome in the majority of day bombardment raids one plane is equipped with a camera and s pictures of the objective together with its appearance ere and after the bombs have been dropped. During the y, usually either while the bombs were being dropped or y they had been dropped the bombing forces would be at- ed by enemy planes and would be forced to fight its way re. The night bombardment planes rely principally upon anness for their protection. They fly at low altitudes, make h attack and then usually return by another route so that h will not be intercepted as they cross the lines.

uring the War the Air Service while engaged in infantry mions learned from experience that it could cause much oteration amongst hostile ground troops by flying low and rping small 15-lb. bombs among groups of men or light arillery, and in some cases by actual machine gunning troops in the trenches or assembled in a mass along roads or other oles. The actual physical results of these ground attacks ve probably not very great, but there is no question as to the ffect on the morale of the troops. In several instances during the German retreat aeroplanes were so fortunate as to see por- of roads crowded with convoys and masses of troops and ve able to fly down on them and drop a few bombs and then and come back sweeping the road with machine gun fire e the surprised columns could take cover or scatter.

his class of work necessitated the design and construction

of a special type of aeroplane called the "Ground Attack" plane. The sole purpose of this plane in combat is low flying over the lines engaging with its machine guns such hostile forces as present a favorable target. This machine has mounted in it a 37 mm. gun which can attack tanks with an assurance that if it makes a hit the tank will probably be put out of commission. In the design of this plane armor plate is incorporated to such an extent that the engine, radiator, gas tanks and personnel are completely covered and safe from small calibre guns. This practically insures the safety of the plane and its personnel while it is flying over the line.

In the St. Mihiel offensive the Air Service was called upon to perform more continuous and harder flying than in any other offensive. The plan of operations as outlined for them neces- sitated the utilization of not only the entire American Air Ser- vice available but attaching to it a certain number of French and British Air Service Units. Our first Army in that opera- tion was composed of the 1st, 4th and 5th American Corps and the French 2nd Colonial Corps. Each Corps had assigned to it an Observation Group which was a component part of that corps and under the direct orders of the Corps Commander. Observation Group for duty with the Army was formed for taking care of all long-range day reconnaissance. Another Observation Group was used for regulating the Army Artil- lery. In addition to this there were quite a few bombing squad- rons and several pursuit groups. The total aeroplanes used in this operation were: 701 Pursuit planes; 366 Observation planes; 323 Day Bombardment Planes and 91 Night Bombard- ment planes, a total of 1481 planes which was the largest Air Service force that had ever been engaged in one operation any time during the progress of the war. In spite of the fact that during the first three days of the operation the weather was bad, command, observation, surveillance and infantry attack planes all accomplished their missions. However, on one day only was it possible to send out photographic missions. The Observa- tion planes penetrated as far as sixty kilometers beyond the enemy's front line at a time when rain was falling heavily and clouds prevented flying at an altitude above 3000 feet.

There were also under the command of the Commanding General, 1st Army, fifteen American and six French Balloon Companies. There were approximately twelve enemy balloons opposite the American Sector. The American Balloon Com- panies moved forward with the advancing line and on the third day of the offensive were sufficiently well-posted to regulate artillery fire and send in additional important information to Corps and Divisional Staffs. During the four days of the offensive the twenty-one balloon companies had moved forward a total distance of Two Hundred Two Kilometers. Despite handicaps of weather, etc. the Air Service contributed materi- ally to the success of the St. Mihiel operations. The Staff was kept informed practically hourly by clear and intelligent re- ports; hostile air forces were beaten back whenever they were encountered; rear areas were watched, photographed and bombed.

Here is what the Air Service did in the last war. It located our own front line and hostile line for the Commanding Gen- erals; took photographs of the terrain in back of the enemy's line for the General Staff; observed and reported on shots fired for the Artillery; bombed and raked with machine gun fire hostile machine gun nests, and points of resistance for the Infantry; carried important personages and supplies for the Quartermaster Corps; made strategic reconnaissances for the Cavalry and messages for the Signal Corps; in especially con- structed ambulance planes carried wounded needing immediate attention for the Medical Corps—and in the great battle of Paris the young pilots put on the dog—for the whole Army.

AIR TRAFFIC

By G. SUDRE

HARDLY had aviation emerged from the experimental stage before France began to think of the improvement in international relations which should accrue from the con- of the air. Nothing could better demonstrate this desire for general harmony than the attempt made in 1910 by the French government to conclude an international aerial con- vention.

is project, not meeting everywhere the same concurrence, was abandoned. It was renewed, this time with success, when the considerable development of aerial navigation during the war of 1914-18 necessitated, at the close of hostilities, the solu- tion of a series of questions, which had yet hardly been touched. regards air traffic, it was necessary to establish general principles, according to which aircraft could circulate in their own country and pass from one country to another.

National Legislation

This was the task undertaken by the convention for regulating air navigation, which was signed October 13, 1919, by the rep- resentatives of 27 governments. The exchange of ratification of this convention was delayed by the fact that the United States and Canada formulated certain reservations which had to be examined.

On the other hand, a certain number of neutral countries re- quested, before giving their adhesion to this convention, that another protocol be added permitting, under certain conditions, derogations of article 5 of the convention of October 13, 1919, an article which obliged the contracting countries to forbid the circulation, above their territory, of the aircraft of non-con- tracting governments.

While awaiting the ratification of the convention, provisional

agreements were made, on the basis of the principles contained in it, between France and England, France and Switzerland, and are now being arranged between France, Holland and Spain. A *modus vivendi* has been established on the same principles between France and Belgium.

The work accomplished by the convention of October 13, 1919, was considerable, since it established the general principles and the scope of international aerial legislation and has consequently determined the interior legislation, which must harmonize with the clauses of this general "chart of the air."

The importance of this document necessitates a brief summary. After establishing a few principles of a general nature, the convention enunciates, in chapters I, II and III, the rules to follow regarding the nationality of aircraft, certificates of navigability and certificates of fitness of pilots. Chapter IV is devoted to air navigation over a foreign country, and chapter V to the rules to be observed in starting, en route and in landing. Chapter VI treats of forbidden shipments (explosives, arms, ammunition, etc.) and chapter VII of government aircraft. Lastly, chapter VIII institutes a permanent body, the "International Commission of Aerial Navigation," which is "placed under the authority of the Society of Nations." This introduces a principle of a more general order than that of most international agreements, which are simple compromises between various and often conflicting national interests. The convention of October, 1919, was thus an attempt to realize an aerial society of nations.

The convention of 1919 having established international bases for national legislation, the French Government was enabled to resume its project of May 7, 1913, which had been abandoned after the failure of the proposed international convention of 1910.

A new legislative bill, signed by the ministers of Foreign Affairs, Public Works, Interior, War, Navy and Finance was deposited March 25, 1920, on the desk of the Chamber of Deputies.

The principles laid down in the convention of 1919 were faithfully followed and the consequences deduced. The rules adopted before the war by the decree of December 16, 1913, and which inspired the legislative bill of the same year, were adapted to the new circumstances and conditions of aviation. This bill, after various amendments, was adopted by the Chamber of Deputies and is now before the Senate.

On the other hand, while awaiting the action of Parliament, there was urgent need of harmonizing the French interior regulations, contained in a decree of December 16, 1913, with the new exigencies of aerial locomotion, as well as with the international agreements already made.

French Interior Regulations

The decree of July 8, 1920, responded to this need and laid down the general principles of aerial navigation in France. It left the details of regulation to a series of orders which appeared during the past year. These documents now constitute the French code of the air. A brief enumeration of the principal ones will sufficiently indicate the breadth and complexity of the problems studied, as well as the very advanced degree of organization already attained by air traffic in France.

Decree of August 9, 1920, regulating the employment of radio for protecting the flight of aircraft (*Journal Officiel*, September 2, 1920; *Bulletin de la Navigation Aérienne*, No. 7, October, 1920).

Decree of August 14, 1920, establishing the conditions for the issuance of certificates of navigability for aircraft (*Journal Officiel*, August 14, 1920; *Bulletin* No. 6, September, 1920).

Decree of August 14, 1920, fixing the registration rules for aircraft and the distinctive marks to be borne by them (*Journal Officiel*, August 14, 1920; *Bulletin* No. 6, September, 1920).

Decree of August 26, 1920, regulating air travel, beacons and signals (*Journal Officiel*, August 29, 1920; *Bulletin* No. 6, September, 1920).

Decree of September 18, 1920, relating to licenses for civilian pilots (*Journal Officiel*, September 24, 1920; *Bulletin* No. 7, October, 1920).

Decree of September 30, 1920, establishing the rules to follow in keeping books on aircraft (*Journal Officiel*, October 5, 1920; *Bulletin* No. 8, November, 1920).

Decree of January 12, 1921, establishing the customs regulations to be observed by aircraft landing in or leaving France (*Journal Officiel*, January 18, 1921; *Bulletin* No. 11, February, 1921).

Decree of June 10, 1921, regulating the transportation and use of photograph and kinetograph cameras on aircraft (*Journal Officiel*, June 23, 1921).

Decree of June 10, 1921, abrogating previous dispositions relating to zones forbidden to aerial navigation (*Journal Officiel*, June 23, 1921).

Decree of August 23, 1921, doing away with the medical examination for the license of the pilot of a touring aeroplane (*Journal Officiel*, August 25, 1921).

Inspection of Aircraft and Pilots

Lastly, a certain number of departmental documents have determined the application of these decrees, as regards the supervision to be exercised over the pilot and aircraft, as well from the professional and technical point of view, as from the physical and material.

Thus the instructions of August 31, 1920, fixed the technical conditions to be fulfilled by aircraft for the obtention of navigability certificates. The instructions of September 18 and 1920, fixed the professional and medical conditions to be fulfilled for the issuance, use and renewal of the licenses of civilian pilots.

The above-mentioned decrees appeared in the *Journal Officiel* of the French Republic. All the supplemental instructions were published in the *Bulletin Officiel de la Navigation Aérienne*. These documents together give to aerial navigation the administrative regulations, in accordance with which it is expected to develop normally.

It was evidently necessary to regulate and coordinate carefully all improvements in aviation, in their various manifestations, in order to avoid, in this branch of the industry which represents both mobility and speed any scattering of energy and anarchic incoherence and the consequent sterility of effort and arrest of progress.

It must not, however, be forgotten that any regulation is beneficial only in so far as it is limited to the efficacious skeleton of a living organism. It is a common characteristic of all fond and anxious mothers to fear all outside contact of their young children, and the French government, which it must be confessed, is bending over the new-born Aviation with passionate solicitude, has not been able to escape it entirely. It is thus that, as regards the customs regulations, the obligation of the technical supervision of the material and the conditions of the medical or professional examinations, certain requirements could be ameliorated without any real disadvantage. May the professional "regulator" be permitted to utter a vow not to regulate matters of the air with excessive prudence. In such matters the regulations of today are liable to become a weight by tomorrow, and weight is the enemy of the aeroplane.

Statistics

The development of air traffic is followed and confirmed by a monthly statement of the traffic of the French air lines, operation and a monthly report of accidents for each aviation company. These statistics cover, for each line, the number of

- (a) Trips scheduled, trips completed and trips partially completed;
- (b) Kilometers flown;
- (c) Paying passengers, Non-paying passengers;
- (d) Kg. of freight carried;
- (e) Kg. of mail carried;
- (f) Fatal accidents, Accidents causing injuries, Accidents causing only material damages.

From January 1 to September 15, 1921, the statistics for French aerial navigation companies are:

1,617,119 km. flown;
8,068 passengers and 112,621 kg. freight and mail carried;
4 fatal accidents;
8 accidents causing injuries only.

Insurance

The matter of insurance in aerial navigation at present leaves much to be desired.

Since November 1, 1919, the French companies have combined in a "consortium" for carrying aerial transportation risks. Premiums in force are, unfortunately, high, the companies striving to protect themselves amply, in new forms of insurance against risks little known as yet. In fact, up to the present time statistics have pertained chiefly to war risks. The risk of commercial aviation can only be determined after a two years of general and carefully collected statistics. We see that such statistics have already been kept for several months.

Insurance rates will be greatly reduced when the "Bureau Veritas" completes the task it has undertaken of establishing an aeroplane register similar to that of the English Lloyd's ships.

(Translated by the National Advisory Committee for Aeronautics)



NAVAL *and* MILITARY AERONAUTICS



General Mitchell in Accident

Milwaukee.—Brigadier General William Mitchell suffered a fracture of three ribs as a result of being thrown from a horse May 28, when physicians made a diagnosis of his injuries. General Mitchell is at the home of his sister, Mrs. Arthur Young, here and will be confined to his bed for several days, it was said.

Training Operations Started at Ellington Field

Training operations, in which every qualified pilot of Ellington Field will participate, began on May 1st. The first week's schedule consisted of tactical formation training by squadrons of full strength. Pilots have been assigned in equal numbers to the 94th and 27th Squadrons.

Activities of the Trade Test Department at Chanute Field

Statistical reports show that during the period between December, 1919, and July, 1921, approximately 1450 students were placed in the Air Service Mechanics School, Chanute Field, for courses of instruction. Of this number 2.2 per cent were dropped for inaptitude, having failed to make the grade of 70 per cent or above. Prior to December, 1919, 32 per cent of the men entered in school were dropped via the inaptitude route, thus showing that the Trade Test Department has been successful in reducing the failures of the school by nearly 30 per cent. Statistics further show that during the functioning period of the Trade Test, approximately 100 men were rejected as being incapable of assimilating any course of instruction taught at the school, thereby effecting a great saving of money, in addition to upholding the morale of the various classes to a marked degree, inasmuch as a man of mediocre intelligence or a slow thinker would impede the necessary rapid progress which students must make.

The immense amount of time and energy expended in the placing of these men in courses which will prove most beneficial to the Air Service and to themselves is not shown in these figures. A conservative estimate of the number of interviews granted, by which the Trade Test Department has attained its enviable record, would reach close onto the five thousand mark, since it is found necessary in fifty per cent of the cases to change the men from their natural desires to a course best fitting their qualifications. The "Natural Desire" is usually the course for Airplane Mechanics or Airplane Engine Mechanics. In placing a man in a course of instruction, three important considerations must be dealt with, paramount among which being the existing orders from the Chief of Air Service that 22 courses of instruction be maintained and in constant operation; secondly, the man's qualifications; and thirdly, the man's desires. The orders from the Chief of Air Service require

that a certain proportion of the students of this school be placed in each of the 22 courses which are taught, in order that each course may be operating at its full capacity at all times. This is necessary in order to supply the organizations with specialists in the wide and varied trades necessary to properly carry on Air Service work. To meet this condition, men sent to this school for instruction must in many cases be placed in courses which at the outset they do not desire. It can readily be seen that if these men were simply ordered to take a course and placed in that course without further notice, a great loss of efficiency would result, for while a man can be placed in a course of instruction he cannot be forced to learn nor to take an interest in his work. Men would be dissatisfied and the morale of the school would greatly suffer therefrom. The task of "selling" the various courses to the men devolves upon the Trade Test Department. It is something which requires tact, judgment, and a high degree of diplomacy, not to mention the great amount of time.

It is due to the great amount of attention and conscientious application given to this matter that the present efficiency of the Trade Test Department is, as before stated, 97.8 per cent. As a testimonial to the success of this method, several men who have completed courses have come to the Trade Test Department upon graduation and candidly admitted that in "selling" them the course of instruction, other than that which they thought they desired, the Trade Test had benefited them, and students, materially.

The compilation of statistical reports above mentioned does not cover the period from July, 1921, to the present date, and of this period much can be said. The first outstanding event in the life of the Trade Test Department for the period named was the ordering of the Chief Trade Expert to Mitchel Field, Long Island, N. Y., where he interviewed and trade-tested 600 enlisted men for the purpose of ascertaining their mechanical and mental qualifications. These qualifications were forwarded to the Chief of Air Service for file and reference. Closely following this, 150 men reported to the Air Service Mechanics School from Mitchel Field for courses, as a direct result of the trade-testing carried on shortly before. It is needless to say that these men proved to be very exceptional material, compared with a later detachment of enlisted men who had not been classified. Thus, the value of the Trade Test was again exemplified. Following this was a period of inactivity, due to the reduction of the army. However, with the transfer of the Air Service Mechanics School from Kelly Field, San Antonio, Texas, to Chanute Field, Rantoul, Ill., the old "go-get-em" spirit was again in evidence in the recruiting drive, which took place in December, 1921, and January, 1922. In selecting men for enlistment, all candidates were given a short preliminary test by the officer in charge of the recruiting station. If, in his estimation, the applicant was deemed de-

sirable, he was sent to Chanute Field and given a trade test to further determine his qualifications. If found suitable for the Air Service by the board, they were enlisted. Before being placed in courses of instruction, all men enlisted were again trade-tested and their records made. During the recruiting drive 713 men were interviewed by the Trade Test Department to determine their qualifications for enlistment in the Air Service. Of this number, 119 were rejected by the Trade Test Department as possessing neither the mental nor mechanical qualifications for Air Service work. Of these 119 rejected men the Trade Test Department was successful in obtaining fifty for other branches of the Service. Again, the figures tell a story, but not the half of it. They do not tell of the midnight oil burnt, of the hoarse voices, of the meals missed, of the perspiration splattered and nobly shed through the line when the old thermo had contracted itself about the zero mark. The foregoing little tale of the Department speaks for itself. Now let us strike off at a tangent.

The Officer in Charge of this Department has so many titles that if he had a tin badge for each one and they were pinned on him, the admiring public would have serious difficulty in discovering his noble physiognomy beneath the mass of medals. In addition to this, he is the lowest ranking member of the school's staff and, therefore, catches every job which is tossed nimbly down the line. Having no alternative, he has to do the work. Nevertheless, he has spent, does and will spend many sleepless nights praying Heaven to send a still lower ranking officer to Chanute Field so that he can engage in the daily diversion of "buck passing." Somewhat of an idea of this man's activity may be gleaned from an enumeration of a few of his titles, viz.: Officer in Charge of Trade Test, E. & R. Officer; Information Officer; Athletic Officer; Publicity Officer; Morale Officer; Member of G. C. M.; Secretary of Officer's Club; Engineer Officer, 15th Observation Squadron; Transportation Officer, 15th Observation Squadron, and Athletic Officer, 15th Observation Squadron. Again a story is told, but not the half of it—not a quarter of it. In addition to handling the duties aforementioned with enviable efficiency, this Department is also the recipient of all jobs, ordinary, extraordinary and otherwise, i.e., selling peanuts, near beer, auctioning off left-overs from the flying circus, organizing baseball, football, and track teams, building tennis courts and baseball diamonds, running picture shows, promoting boxing matches and coaching athletic teams.

These are only some of the glorious tasks accomplished by this Department. It has done everything that is possible to be done on a large and well ordered flying field, even unto caring for the Pathe News camera man, who at one time infested the field for the purpose of photographing parachute jumps and other aerial activities. This Department is proud of its record. "Grin and bear it" is the motto; "Lay on MacDuff" is the slogan.



FOREIGN NEWS



Wireless Position-Finding for Aircraft

The British Air Ministry issued recently the following memorandum: Since October of last year a wireless "position-finding" system has been under trial to enable air pilots to ascertain their position when flying on the Cross-Channel Airways. This system has, on several occasions, proved to be of particular advantage in adverse weather conditions, and has been introduced as a regular feature of the civil aviation wireless service. It is a further development of wireless direction finding which, during the past two years has proved of such great value to air navigation.

Until last October direction finding work was carried out only by the Civil Aviation Wireless Station at the London Air Port of Croydon, and was limited to giving a pilot his compass bearing from that station. The Direction Finding station at Pulham Airship Base, Norfolk, has been successfully operated as the second station of the system during the past six months, thus enabling two bearings to be taken simultaneously upon a single aircraft, and its position determined by plotting the bearings upon a chart, the point of intersection giving the aircraft's position.

Direct intercommunication between Croydon and Pulham is effected by radio-telephony, and the pilot can be informed of his position with a high degree of accuracy under normal conditions. The radius of action for giving position is approximately 200 miles from the control station, which in this case is Croydon. Although primarily designed for radio-telephony, the system is equally adaptable for radio-telegraphy; the change over being carried into effect by a simple switch in a few seconds. The position can normally be given within two minutes. Similar facilities can be afforded from Croydon to aircraft engaged on inland flights and services.

Several instances have already occurred in cases of fog and storm where pilots have been informed of their position and enabled to reach their aerodromes in safety. The most noteworthy occasion was in February last, when an aeroplane flying over the airway between Paris and London was navigated entirely by wireless, the pilot seeing the ground only on one occasion for a few minutes.

Pilots and navigators have been strongly urged in a Notice to Airmen which has just been issued explaining the working of the system, to make a practice of utilizing on every flight this important aid to navigation, as the experience gained in the use of position finding in good weather when pilots should be able to check the accuracy of the positions will add to their confidence and proficiency in using the system when flying in bad weather.

It is therefore hoped that they will take full advantage of the opportunity thus offered of increasing the security of air navigation.

British Seaplane Floating Dock

It is announced that the seaplane floating dock, which has been under construction at Sheerness Dockyard to the orders of the Air Ministry, has now been delivered as ready for service. For the present, the craft has been berthed in the Medway, near Port Victoria. The dock, which has an over-all length of 143 ft. and a lifting capacity of 200 tons, will accommodate two large modern seaplanes, has thirteen buoyancy compartments, each flooded direct from the sea and emptied by blowing with compressed air. The power for the air compressors is supplied by two oil-driven dynamos, which also provide the current for lighting and power for workshop machinery, capstans, winches and pumps. An interesting feature is the supply of petrol to seaplanes from a large storage tank on the deck by means of the Bywater hydraulic system.—*Flight*.

Franco-Roumanian Co.

The Franco-Roumanian Air Navigation Co., which has been running an air service from Paris to Prague and Warsaw, is now about to inaugurate an extension of their service from Prague to Vienna to Budapest. The new service is to run three times a week, and the time taken will be two hours from Prague to Vienna and about 1½ hours from Vienna to Budapest.

French Seaplane Contest

The French seaplane contest (Marseilles-Monaco-Marseilles) was run off on April 19th, when six naval and two civilian pilots took part. M. Eynac, Under Secretary of State for Aeronautics, evinced the keenest interest in the event, and had flown, in a Goliath, from Paris to Marseilles, in 5½ hours flying time, a couple of days previously, in order to be present at the start and finish. The finish found M. Poiree, on a 135 h.p. Clerget-Caudron, the winner in 5 hours, 1 min., Brou on a Farman being second in 8 hours and 14 minutes.

Aircraft Industry in Austria

The Australian Aircraft & Engineering Co., has recently submitted a request to the Government for a subsidy to establish and develop the aircraft industry in Australia. The company states that, unless further orders are placed by the Government, it will be out of work in three months, on completing the six Avro aeroplanes it is now working on at Mascot, New South Wales. Australian timber is being used by the company, and it builds all parts of the aeroplanes except the engines. —*Industrial Australian*.

Aviation in Argentina

It is estimated that there are 173 aeroplanes in Argentina, of which 53 belong to the army. Of the total number, 88 are French, 30 are American, 24 are British, 4 are Italian, 11 are German, and 16 are of various makes. The Compania Rio Platense de Aviacion made 84 trips and carried 281 passengers between Buenos Aires and Montevideo up to March 1. The cost of the round trip between the two cities is 140 pesos, including the automobile transportation to and from the field. The time of flight is 1 hour and 45 minutes, in contrast to the trip of 9 hours by boat which costs 45 pesos. (Trade Commissioner George S. Brady, Buenos Aires)

Commercial Aviation in Peru

The existing transportation situation in South American countries appears to be one requiring considerable development, and to those who find it necessary to make frequent journeys over long distances it means much delay, discomfort and inconvenience. The remedy for this state of affairs would appear to lie in the advent of commercial aviation which, if organized along the proper lines, should tend to greatly facilitate travel and aid in no small measure in the development of those countries.

A recent issue of the *West Coast Leader*, Lima, Peru, prints an interview had with Gen. A. S. Cooper, Representative in Lima of the Peruvian Corporation, giving an interesting account of an aeroplane journey made by him to inspect his Company's properties in northern Peru, using one of the machines of the Cia. Nacional Aeronautica. He returned safely from his trip after an absence of six days, having covered an area of territory which by normal means of transport would have required as many weeks.

In the course of his interview, General Cooper spoke as follows:

"My difficulty in making periodical inspections of our properties in Chimbote, Trujillo, Pacasmayo and Paita is the steamer communications. At the best, by using launches, motor cars and steamers, it is possible to do it in about 25 days. This means about 10 days' work, 15 days' waiting and traveling, with much discomfort and inconvenience. I managed to hit off a Paita connection, but gave up the problem in despair of steamer connection in anything like reasonable time for the other ports.

"It occurred to me to ask Mr. Mott to call, with the result that he assured me that his company could solve the problem without the slightest difficulty. He informed me that he made a specialty of safe commercial flying and offered to place an aeroplane and pilot at my disposal at what I considered a very reasonable price.

"A short consideration showed me that his proposition would result in a very considerable economy, taking into calculation the saving of time and the various expenses incidental to a combined launch, steamer and automobile proposition as incurred in my last inspection. Although I had some small experience in England of flying during war time and was not so certain of the comfort and safety, I, however, accepted Mr. Mott's assurance and left at 11 a. m. on the 22nd, in an ordinary Standard Curtiss 90 h.p., with Mr. Moore as pilot. We arrived at Chimbote at 3:45, at landing in Supe for petrol. This was an amusing incident. Mr. Moore circled over Supe and cut off his engine three times and then proceeded to a landing ground about 1.5 kilometers from the town. He got out of the machine and lighted a cigarette, and I said: 'What happens now?' He replied, 'A burro will come with gasoline.' In a few minutes we saw the donkey coming over the Pampas, urged by his owner, with three tins of gasoline, equal to the number of times that Mr. Moore cut out his engine over the town. The humble, but necessary, burro supplied the flying power to the machine and we were soon off again. I finished my work at Chimbote in two days, and at 1:10 o'clock on the 24th we left for Trujillo, arriving at 2:25, and landing on the football ground.

"We left Trujillo on the 26th, at 1:35, after a very courteous 'despedida' (farewell) by the Prefect, Colonel Derteano, and landed at Pacasmayo at 2:30. Mr. Moore had never landed at Pacasmayo, but I had given instructions for a suitable spot to be marked out—the requirements were not fully understood, and we had to land on an incline and across wind. However, this did not beat the pilot, and with a wriggle and kick and a small pancake he brought the machine to earth in front of about 500 admiring natives, for whom the enterprising railway manager had run over a cheap excursion. Mr. Moore afterwards selected a suitable ground.

"We left Pacasmayo, homeward bound, at 6:30 a. m. on the 28th, and as flying is hungry work, I arranged for desayuno (light breakfast) at Chimbote, finished up some work there; left at 10:10, picked up gasoline again in Supe, and arrived at Bellavista at 2:45 in the afternoon, after a 360-mile flight from Pacasmayo. I ungrudgingly admitted after landing that Mr. Mott's assurances as to security, convenience and comfort had been entirely substantiated. At no time during the journey did I feel any sense of insecurity, and Mr. Moore was always ready to start at the time I decided. I was particularly impressed with the care with which he tried over the machine and engine each time before leaving the ground.

"Whilst passing over barren parts of the coast I took a nap on one occasion and read a book on others. Mr. Moore flies at a very even pace and at a height of between 2,500 and 4,000 feet, and hardly uses his controls when in the air—or did not appear to do so—and I felt that in case of any mishap he could have landed the machine in safety.

"At times we passed through patches of thin air and experienced some bumping which, to a comparative novice, is a little disagreeable, but the extraordinary control which Mr. Moore has over his machine minimized the discomfort, which probably would not be felt at all after more experience.

"Even on the barren stretches of coast the coloring is always wonderful, and when over the openings of the various fertile valleys the view is extraordinarily pretty, especially after leaving Salaverry and approaching Santa Catalina Valley. One sees Trujillo appearing in a beautiful green setting, with its neat squares and streets and eastern looking churches and coloring, and a little beyond the Inca remains of Chan Chan are very clearly marked, also with squares and streets.

"The Chicama Valley with its enormous extension of intensive sugar cultivation is also very notable, with the large factories of Cartavio and Casa Grande. At about 4,000 feet the whole valley is spread out before one.

"I was sorry when the journey was over and also to say good-bye to a most pleasant traveling companion, and I shall certainly repeat the experience when occasion offers. A trip of this kind opens one's eyes to the possibilities of carefully organized commercial flying, especially in a country of difficult communications like Peru."

Austria's Air Achievement

The Australian Controller of Civil Aviation, Colonel H. Brinsmead, has set about his task in a wholehearted manner as the aerial routes already started in Australia bear witness. In connection with this work Colonel Brinsmead has recently completed a 9,000 miles aerial tour on the "Bristol" Tourer provided for his use. The flight, during which thousands of miles of practically unknown country were traversed, ranks as one of the finest flying achievements which has yet been recorded. To carry out this trip by any other than the aerial route would have been practically impossible. This flight must be added to the aeronautical feats already achieved by such notable Australians as Sir Ross Smith and Lieut. MacIntosh, and speaks well both for the Australian flying spirit and for the British design and workmanship embodied in the machine.

Branker Civil Aviation Director

The British Air Ministry announces: Major-General Sir W. S. Branker, K. C. B., A. F. C., has been appointed Director of Civil Aviation in the Air Ministry.

ELEMENTARY AERONAUTICS and MODEL NOTES

Model Aeroplane Details

(To be continued next week with illustrations of details mentioned)

DETAILS are an important consideration in anything, and especially in model aeroplanes. Therefore it would be well for anyone attempting to build a model to study carefully the drawings of the model, and more carefully study the details. Many of the I. M. A. C.'s so-called "secrets" are in this list of details; most of them have been used in the record breaking models and have enabled the club to capture and retain the whole ten of the officially recognized world's records. The records in no instance were made during freak weather conditions or from a favorable altitude—the field over which the land records were made being nearly as flat as the lake over which the Hydro records were made. These models hold their records on their merits alone, which means attention to details and design.

"CANS"—Tractor

Cans are one of the chief reasons for the light weight of the machines of the I. M. A. C. members. Even beginners, by the use of these cans, exceed the records held outside the club. The principle is so very simple—being the same practically as the eyelets on frail flexible fishing rods. By keeping the pull in either case more nearly parallel to the stick or rod, the fullest compressive strength of the material is utilized, because the sticks are not put to near so great a bending strain.

The first cans were really *cans* for they were in the form of a sleeve an inch or more in length and made from a tin can strip. Aluminum was then tried in the search for light weight. Then light strips of bamboo were used with a great deal of success for they were very light and stood a great deal of punishment; but one had to be very good at bending bamboo to make the small curves necessary.

Steel piano wire seems at this date to be the best for they are light, strong, and easy to form. The wire can even be flattened to streamline but this is not necessary. Great care should be taken not to get the cans too small or the rubber will catch on them. The size of the wire used is usually about as follows: No. 8 for six strands on a tractor, except the rear can which is always heavier to take the force of the rubber should it break, and others in proportion to the amount of rubber they must stand. The size of the opening runs about as follows: for two strands of $1/32"$ sq.— $5/32"$ dia. cans; 2 st. $1/8" \times 1/32"$ flat— $7/32"$ dia.; 2 st. $3/16" \times 1/32"$ lat— $1/4"$ dia.; 4 st. $3/16" \times 1/32"$ flat— $3/8"$ dia.; 5 st. $3/16" \times 1/32"$ flat— $7/16"$ dia.; and for 6 st. $3/16" \times 1/32"$ flat rubber, $1/2"$ oval cans were used. The cans never receive any great strain except when the rubber breaks and this should not happen very often. However, care should be taken to fasten the cans securely to the stick for many contests have been lost through the loosening or losing of a can.

"CANS"—Twin Pusher

Twin push cans should be made of slightly heavier wire than is used for tractors on the same number of strands, because they are usually only supported on the one side. The opening may also be made larger for they do not take any strain unless the wing or a bad landing temporarily bends the motor-base, while the cans on a light tractor motor-base take some of the constant bending pull which must be kept as low as possible by small cans keeping the rubber close to the motor-base. In a twin there is no bending strain except at the rear can next to the propellers which can be stopped by a thread across the X brace. Two, or better still three cans is the common number for twin or tractor.

"S" Hooks

A—is the old style of "s" hook. It always slipped out of the winder or the front hook of the model and caused much trouble. B—is a much better shape of "s" hook for it will not tear the rubber when it is being slipped into the hook and if properly made it will not slip out of the front or rear hook as the case may be. There is more wire in it than A and it is a much better hook and is not much more difficult to make. C—is no better than B except that it can be made of lighter wire because of the safety hook arrangement. It is hooked like a safety pin and the rubber inserted then it is locked up again. No. 5 wire will hold 2 strands of $1/8"$ flat

rubber; No. 7, 2 st. $3/16"$ flat rubber; No. 11, 4 st. $3/16"$ flat rubber; No. 12, 5 st. $3/16"$ flat; No. 13, 6 & 7 st. etc. This covers all the power units common to I. M. A. C. models. One or two sizes smaller wire can be used with the safety hooks but that is getting on dangerous ground. Always have the one side of the "s" hook big enough to fit in the winder yet small enough to prevent it from coming unhooked during flight.

Twin-Push Motor Hooks

Hooks for large or small machines can be made as shown. A good plan is to have the eyelets that the "s" hook fits into longer than seems necessary in order that there will be no opening for the "s" hook to slip out of. The wire sizes are the same or one size larger than the "s" hook for the same number of strands.

Tractor Motor Hooks

Follow the same good plan of extending the wire past the upright piece on the part where the "s" hook fastens, to prevent the "s" hook from slipping around and coming out. When a frail wire hook is used the rear end of the eyelet should be twisted around the upright part of the eyelet to prevent it from coming out.

Hangers and Bearings

These hangers are of the lightest and strongest style as well as the simplest bearing in one piece yet devised. "C" shows a common nail without a head as used in making a bearing. "B" shows the nail flattened on both ends and drilled through the head end. "A" shows the finished hanger after being bent and the drilled hole countersunk from the rear, filed smooth, corners rounded, and the position it is mounted on a twin pusher.

Wire Bearings

Wire bearings suitable only on small models and then mostly on tractors. "A" shows one kind fastened to the top of the motor-base. "B" is a variation in which the one end is pushed through and bent on the bottom of the stick. This is not supposed to come loose but if "A" is fastened on well the extra trouble required to make "B" is wasted. Make the hole as round as possible.

Motor Base Sections

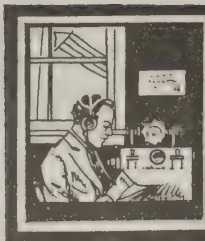
Motor base sections are an important consideration for at least one quarter or more often one third of the total weight is in the frame. "A" is the most common style of motorstick. It is generally pine or spruce planed to size with the corners well rounded for streamline. The size shown in the drawings would easily hold five strands and would hold six if well braced on a twin push. For a tractor it would just hold four strands and possibly five well braced with cans. "B" is a section of a hollow spar (incidentally a section of B. Ponds record tractor). The easiest way to make these is to make a U-shaped section and then glue a cap on to it. The cap must be fastened securely. The spar should be held tightly against a flat surface while the glue is setting. The U-shaped section of the cap can be quickly made to the approximate size on a circular saw and finished with a plane and sandpaper.

"C" is the section of a Balsa spar suitable for six strands. This spar is well rounded to streamline it. "D" is practically a full size section of Mr. B. Pond's dual world's record channel-spar twin push frame. This frame stood five strands nicely. It was easily constructed with the use of a rounded wood-carver's chisel. "C"—"D" are not suitable for tractors but a Balsa spar of the size and shape of "B" should hold (hold in this case means just hold) five or six strands or about the same as a hollow pine spar of the size shown with walls .025" in thickness. "B" will hold 8 or 9 strands on a twin pusher.

Balancing Hook

A balancing hook for propellers is made from a small piece of piano wire. The shaft of the propeller "C" rests down on "B" and rests up against "A". With the aid of this hook the heavy side of a propeller can be detected and corrected. All propellers must be accurately balanced for the best results.

(To be continued)



RADIO DIGEST



Overland Radio of Air Mail Completed

Some time in the near future, when you are juggling with your controls and get on a moderately long wave, if you should happen to hear some one saying "This is Jones, on No. 6 night mail, west-bound, in thick fog, altitude 3,000 feet," do not be surprised nor alarmed. You will be listening to one of the United States air mail planes reporting by radiophone.

The Air Mail Service is doing some wonderful pioneer work, despite the fact that Congress has been extremely niggardly in allotting appropriations to that important service. It is laying the foundation for the future commercial air transport that will revolutionize physical communication in this country. In addition to this, however, it is also developing the most modern form of instantaneous communication which will materially aid in removing the last remaining preventable cause of aircraft danger.

The splendid program of communication development planned by the Air Mail Service is now being completed and should be in full operation within the next six months. This program will include a complete network of intercommunication across the entire transcontinental air route, as well as complete means of intercommunication between aircraft and between aircraft and ground stations.

Radio Compass System Complete

In addition to this there will be a complete system of radio compass stations to guide machines straight to their destination, and there will also be radio field locaters, which will enable aeroplanes caught in a fog to spiral gracefully down to a safe landing in the center of the field, despite weather conditions. With these complete systems in full working condition night flying (which is imperative to a successful air mail service) will be made not only possible, but measurably safe.

The most remarkable thing about this development is the fact that the officers responsible for it did not permit the parsimony of Congress to interfere with their plans. Having been cut down to the last cent by an unsympathetic appropriating body, the officers simply changed their tactics and developed the more essential parts of the system first, and left the application of the entire system to a more favorable period. The story of their achievement is best told in chronological form, and it is a story of real historical value.

It began shortly after the inauguration of the Air Mail Service, when the only practicable route was between New York and Washington. In the latter part of 1919 extensive experiments were made with radio direction finders upon aircraft flying between those two cities. The instruments upon the aeroplanes were designed with the prime idea of simplicity compatible with successful operation, in order that a minimum amount of attention would be required of the pilot. These experiments were eminently successful, and as a result of them the surest method of air navigation has been developed—the radio compass.

During the period of these experiments it was realized that while the radio direction finder and the radio beacon stations

would permit an aeroplane to determine its exact position, the system itself would not permit a pilot to make a safe landing in foggy weather when he had reached his landing field.

Radio Field Locator Developed

The solution to this difficulty, it was realized, lay in devising a system of radio communication that would indicate to the pilot just when he was over the center of his landing field, so that he could spiral gently down through the fog. As a result of this determination the radio field locator was developed successfully.

In the fall of 1920 radio communication and radio aids were applied to the big twin engined Martin mail planes and a radio operator was placed aboard the machines of this type. In the terse words of the official report upon these operations "great success was obtained and these radio adjuncts were developed to a practical point."

It was at this juncture, however, that Congress stepped in and put the brakes upon further rapid development by cutting down the already meager appropriations for this service. As a result of this situation the officials of the air mail service were compelled to abandon completely all further experimentation with radio apparatus aboard the aircraft, and due to the act of Congress the air mail planes have been flying for two years without any of these necessary means of communication.

In the mean time, however, the officers of the air mail were not to be discouraged by this situation; so, thwarted in their major purpose, they went ahead as best they could with the facilities at their disposal. The result is that after two years of intensive work there exists at the present moment a complete network of intercommunication across the country operated by the air mail service.

Fifteen Stations in Service

This communication service consists of no less than fifteen five-kilowatt arc wireless telegraph stations and one large radiophone communication. The former have a normal daylight communication range of approximately 400 miles, and of course, much further at night. In addition to their value as a means of intercommunication the stations can also be used for airplane control work—such as radio direction finding and for the purpose of issuing orders to pilots of mail planes while they are en route between two air mail stations.

Now that this ground system has been established, officials of the Postoffice Department, in a letter, inform me that the work of equipping airplanes with direct finders and radio telephones is now under way. The preliminary installation is now being made, and there is every prospect of the operation of a complete system on the planes within the next six months. The work is being done in conjunction with the plans for the development of night flying along the transcontinental air routes.

As a result of the splendid development program of the air mail service, the investment represented in the establishment of the transcontinental communication system has been wisely made, and from pres-

ent indications the government will soon recover its cost in the amount saved from the transmission of messages. In this connection the report sent to me reads as follows:

"Our ground control stations now handle an average of about 600,000 words a month at a cost of approximately \$0.00 a word, based on expenses of operation and maintenance over the whole circuit."

This in itself is a remarkable record but when the possibilities of the system in connection with rendering safety service to aircraft are taken into consideration also, the value of the investment to the people of the country becomes apparent. There should be no stifling of the air mail development.—Jack Binns, in N. Y. Tribune.

Almost Twenty Thousand Radio Sender in U. S.

A survey of all radio transmitting stations licensed by the Department of Commerce shows that there are 19,067 stations. Of this number 15,495 are amateur stations, 348 experimental, 2,783 American ships, and the balance, 439, commercial stations.

Of this last number, there are today 274 broadcasting stations, known as limited commercial stations. They comprise universities, municipalities, newspaper electrical manufacturers and retail stores sending entertainment or information of weather, crops and market reports.

The growth of this class of radio stations has been remarkable; it jumped from sixty-seven stations a little over two months ago to 274 today. Applications are filed on an average of about three or four a day.

Transmitting Stations

Trans-oceanic	1
General public or "ship in shore"	3
Point to point	12
Broadcasting	27
American ships	2,783
Experimental	348
Technical and training schools	1
Amateur	15,495
Special amateur	20

Total

Amateurs by Districts

1—Boston	2,400
2—New York	2,300
3—Baltimore	1,800
4—Baltimore (Savannah)	300
5—New Orleans	600
6—San Francisco	1,600
7—Seattle	700
8—Detroit	2,300
9—Chicago	2,900

Total

The Department of Commerce does not regulate or record receiving stations and will not guess at the total number, now officially estimated at about a million and a half.

Pick With Care The Parts for Loud Speaker

By B. BRADBURY

Radio Engineer, General Electric

After some weeks or months of listening to radio broadcast programs by the u

head receivers, it generally becomes desirable to install a loud speaking device which will make the signals audible throughout the room and enable several people to hear from at the same time. There is also the further desirability of having signal intensifiers loud enough for dancing or concerts, where the music must be heard throughout a fairly good-sized room.

To secure this amplification and at the same time maintain the original quality of the signal, it is necessary to observe a number of precautions in the selection and construction of the apparatus used.

Assuming that the signal directly from the detector is of good quality and loud enough to be heard distinctly in the head receivers, our problem is chiefly concerned with the maintenance of this quality, since this is a comparatively simple matter to obtain the necessary intensity.

In order to eliminate or minimize loud speaker distortion it is necessary to know the causes involved. The source of trouble may be in the amplifier, in the loud speaker itself, or in both.

For good amplification of telephone signals, the interstage transformer should be capable of giving a uniform transfer of energy from about two hundred to three thousand cycles a second. A good many transformers in use do not do this, and their operation is one of the principal causes for unsatisfactory signals. For any particular plate voltage applied to an amplifier tube there is a corresponding value of negative grid voltage which should be applied in order to operate upon a straight portion of the characteristic curve, and thus secure uniform amplification. With fifty volts on the plate the negative grid bias should be about one volt, and with 100 volts on the plate the grid bias should be about four volts negative. Standard amplifier tubes will generally operate with two tubes in cascade without overloading them. Where more volume is desired for very strong signals it is preferable to use for the third stage a smaller tube with three or four hundred volts on the plate. The grid voltage in this case should be about twenty to twenty-five volts negative. This will hold the plate current down to normal value and operate upon a straight portion of the characteristic. It is also well to use reactance coupling between the second and third stages, as this will cause very little distortion and will give good amplification.

When connecting to the loud speaker, especially when using a power tube for the last stage, it is preferable to use an intermediate transformer with the proper constants, instead of placing the loud speaker directly in the tube plate circuit. This keeps the plate current out of the loud speaker winding and prevents the paralyzing effect that it would have upon the diaphragm.

A two-stage amplifier will generally give enough intensity to operate a loud speaker in an ordinary living room, while the loud speaker mechanism itself may be of the head telephone type with a suitable horn. Some receivers operate very well at moderate intensities, but when very strong signals are applied to them they vibrate so violently that the diaphragms hit the pole pieces and produce harsh sounds instead of good reproduction of the original signals. To handle the proper amount of energy, therefore, the construction must be such that reasonably strong vibrations will not force the diaphragm to its limit of travel. The material and shape of the diaphragm are also

important in determining the resultant tone qualities, since whatever natural periods of vibration it may have will bring out certain tones in greater proportion than they should be to the remaining tones of a musical selection.

The size, shape and material of the horn are likewise important factors in the final result. The high natural period of a small horn will tend to accentuate the higher tones to the exclusion of the lower ones. The material from which the horn is made should be some substance which will not vibrate readily and produce rattling sounds.—N. Y. Tribune.

Loop Aerial for Autos Made Upon a Parasol

Many types of portable wireless receiving sets have been devised, but in all cases it is necessary to provide a ground to complete the circuit and in most cases it is necessary to stretch an aerial when signals are desired. Neither is necessary in a new parasol receiver just recently perfected by John B. Taylor, consulting engineer of Schenectady.

This parasol outfit is very simple in construction and easy to operate. It is very compact and light. A loop aerial of braided copper wire, which is very flexible, is sewed to the covering of the parasol in parallel lines, resembling braid, near the edge. Either end of this wire leads through eyelets along the main road to the handle, where a small condenser and crystal detector are attached. By varying the condenser, the set may be tuned for the different sending stations' wave lengths. On this small apparatus on the handle are attached the headphones, and all that is necessary to hear the signals or concerts from any station within the range of a crystal receiver is to point the parasol in the direction of the station. It operates much the same as a loop aerial in this respect.

The parasol can be lowered just as easily as any parasol. There is nothing freakish about its appearance and when closed looks just the same as any other parasol.

Mr. Taylor has made frequent tests of the device in the vicinity of Schenectady and has been able to hear signals and music broadcast from WGY, when ten miles away. Evenings while motoring in his car, he raises the parasol in the back seat and can plainly hear the concerts from WGY while riding about the suburban sections of Schenectady.

Protest Radio Ban on Political Talks

Washington.—The American Radio Association is dissatisfied with the decision of the Government to refuse permission for the broadcasting of political speeches by Government radio and intends to seek a modification of the new rule.

F. W. Brown, executive officer of the association, said that he would take up the matter immediately with Secretary Hoover with a view to having him issue orders that beginning two weeks prior to the November elections and lasting until election day, candidates for public office shall be permitted to use the Government radio stations for broadcasting addresses during certain hours of the day.

"The majority of people are interested

in politics," said Mr. Brown. "Through a canvass of the thousands of members in our organization, we find that approximately two-thirds are eager to hear the various men running for office. Such a step taken by the Government would meet with the approval of the majority of radio enthusiasts, we feel certain, providing that there is a limit of two weeks, and permissible during certain hours of the day only. We do not think that the air should be full of political speeches all day long, however."

The decision of the Government to refuse permission for the use of its radio service for broadcasting political speeches was announced on May 20, when Theodore Roosevelt, Acting Secretary of the Navy, notified representatives of the Woman's Party that he would be obliged to deny their application for the use of the naval radio service for broadcasting speeches and music on the occasion of the dedication of the Woman's Party headquarters in Washington on May 21. He gave as a reason that it had been decided to discontinue the practice of permitting naval radio to be used for political purposes.

The action of the Acting Secretary of the Navy caused surprise, as Secretary Denby was understood to have granted previously the permission sought by the Woman's Party received a letter from cation ceremonies the officers of the Woman's Party received a letter from President Harding withdrawing the acceptance he had given in December to the invitation to attend the dedication. No explanation for the declination was contained in the President's letter.

There has been considerable mystery over the action of the President and the Acting Secretary of the Navy. Nothing has appeared to indicate that either the President or Acting Secretary Roosevelt had any objection to the Woman's Party as an organization, but it is evident that the rule to refuse permits to use Government radio for sending out political speeches had a connection with the dedication of the party's headquarters.

Radio Controlled Aeroplanes

Control of aeroplanes by radio is recorded as a notable achievement in France. A large machine was taken up. The pilot allowed his "ship" to be maneuvered for over an hour by wireless operators in a land station far below. At a given signal the pilot resumed control and landed.

Government Gets Share Radio Boom

Over 2,000 per cent increase in revenue was derived by the United States Government from private and commercial radio stations in 1921 over the year 1917. The earnings of these stations are estimated to be in excess of \$1,600,000 and show a profit of more than 15 per cent on the Government's investment of \$25,000,000.

Sweden to Talk to America

Sweden expects to talk direct to America when the gigantic station in that country is completed. An agreement with the Radio Corporation of America and the Swedish State Telegraph Board will bring about the undertaking. Sweden's wireless communications are now dispatched from the station at Stavanger, Norway.

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WEEKLY

5, No. 15

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Buyers are reminded of the Sealed Bid Sale of Aviator's Clothing—Moleskin and Leather Coats, Leather and Canvas Breeches, Gauntlets, Goggles, Helmets, Electrically Equipped Flying Suits, etc., closing July 6th, 1922.

Write immediately.

Make a date now with yourself to be present at this sale on July 11, at the Curtiss-Elmwood Air Reserve Depot, 2050 Elmwood Ave., Buffalo, N. Y. The value to you of participation in this sale will be more apparent after you get a catalog by writing the Commanding Officer at the depot, or

Chief, M. D. & S. Section, Air Service

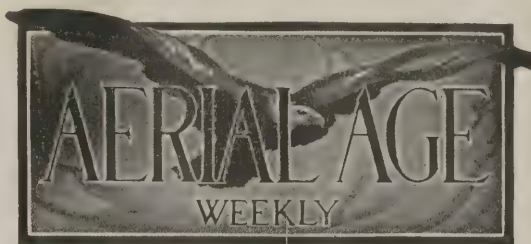
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WASHINGTON, D. C.



WAR DEPARTMENT

June 26, 1922



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NEW YORK, JUNE 26, 1922

No. 16

IMPORTANT EDITORIAL ANNOUNCEMENT

WITH this issue AERIAL AGE will cease publication as a weekly magazine. It will henceforth appear as a monthly. The first issue in the new form will be dated August 1st, 1922, and will appear on July 18.

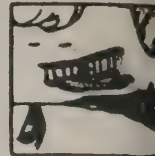
This change has been decided on after the most careful consideration of the present aeronautic situation and in an attempt to produce a magazine that will best develop and increase interest in aeronautics on the part of the American people.

The new AERIAL AGE will be greatly increased in size, will be printed on better quality paper, with cover in two colors. It will contain all of the regular departments and features of the present AERIAL AGE, and will have in addition specially written illustrated articles by world authorities, written from the point of view of increasing public interest in aeronautics.

It is contemplated that such a magazine will have a much wider appeal to the American people, and only by such a widespread appeal can we hope to be successful in properly presenting aeronautics to the American public.



THE NEWS OF THE WEEK



Detroit Aerial Carnival

The first aerial carnival and flying meet for Detroit will be held under the auspices of the 310th Aero Squadron, 85th Division, U. S. A., on July 1, 2, 3 and 4. The preliminary announcement concerning the carnival follows:

In the past, Detroit has been sadly lacking in its aviation enthusiasm. One of the most important reasons for holding this meet is that, while Detroit and Wayne County have had assigned to them a Reserve Aerial Squadron, designated as the 310th Observation Squadron, 85th Division, U. S. A., Congress has failed to provide sufficient appropriations necessary to carry on the practical work such as the squadron requires to be accurate. Therefore, to secure the enthusiasm and support, civic and industrial interest of the community, it was felt that some tangible demonstration should be given to attain these ends.

The success of this event will not only enable the squadron to obtain the necessary funds to carry on operations at Selfridge Field, but will arouse interest among public and industrial organizations in this locality in preparation of the coming era of aerial transportation and the benefits of having Detroit on the Aerial Mail Route. The whole object is to promote aviation activity in every sense of the word.

The event will be supported in part by the Detroit Aero Squadron, a pure "dyed-in-the-wool" live organization, composed of between fifty and seventy-five flyers who have served in the American and Canadian Air Forces during the World War; in addition to a large number of observers, combat gunners, air service engineers, balloon men, mechanics and others familiar with the work and possibilities of aviation.

The First Air Carnival and Flying Meet is designed to interest the public from the commercial and industrial point of view, rather than from a sporting standpoint. It is particularly valuable from a viewpoint of National Defense and Preparedness, because our Government does not maintain a completely equipped and operating Air Service in times of peace.

Therefore, only through encouraging and upbuilding a Merchant Air Marine of trained personnel, by those qualified, can

the country in general realize the great economic possibilities of Aerial Transportation. These two organizations are foremost in both lines of endeavor; one from the military standpoint, whose training was secured at enormous expense during the war, and others who have had a great deal of experience but are not connected with military organizations. All of this experience and enthusiasm will be given towards making Detroit the hub of aeronautic activities in the United States—which means the development of Commercial Aviation in Detroit and the opening of many possibilities from an industrial standpoint.

Larsen Responds to Rickenbacker

New York—Aroused by what he terms unfair criticism of American aviation, in statements attributed to Capt. E. V. Rickenbacker, whose plane was so badly damaged at Omaha, Neb., that he was forced to abandon his around-the-country flight, John M. Larsen, who improved the all-metal monoplane, issued a statement pointing out that there are many machines which could have made the trip successfully. Rickenbacker is quoted as saying, "no plane in the United States is fitted to make such a tour."

"Capt. Rickenbacker was my guest on a flight across the continent and back," said Mr. Larsen. "We made the trip easily. A pilot, a mechanic, and I flew from Omaha to Philadelphia two years ago without stopping, between daylight and dark. We carried much baggage also. The U. S. Air Service is flying many kinds of machines every day, and the Air Mail flies daily between New York and San Francisco with an efficiency performance of 95%."

Mr. Larsen, who is a Governor of the Aeronautical Chamber of Commerce of America, said that reports received by the Chamber indicate that more than 250,000 civilians flew in aircraft last year, more than 3,000,000 miles. He himself traveled from New York to the Arctic Circle and down into Mexico before returning to Manhattan in the same plane in which he started. He has traveled more than 300,000 miles by air.

"Most of my flying has been done in

planes of similar type as that which Rickenbacker attempted to use," said Mr. Larsen. "The machine he used was an obsolete model, two years old, and one of three or four which had been withdrawn from the Post Office Department and sold, for a few hundred dollars, as salvage. They lacked the improvements I have made on the all-metal monoplanes since first introducing them into this country. Personally I think Capt. Rickenbacker was misquoted or that he made the statement without realizing its full meaning."

Spokane News

Spokane, Wash.—Interest in aviation this city has been substantially stimulated as a result of the visit to the city of Rear Admiral W. F. Fullam, U. S. Navy, retired. The admiral is swinging around the circuit of army corps areas as the representative of the National Aeronautical Association. He has a breezy personality of exceeding charm and makes an exceptional efficient envoy for the organization which planned the tour.

Arriving at Spokane early on the morning of June 5, Admiral Fullam was met at the depot by a delegation of representative citizens, including the mayor of Spokane and president of the Chamber of Commerce. Military Affairs Committee of the Chamber of Commerce is especially charged with the development of aviation in Spokane, and the committee was well represented in the reception committee. Thereafter Admiral Fullam's time was fully occupied. He spoke at the high school auditoriums, addressed the Chamber of Commerce, spoke to the garrison at Fort George Wright and was entertained at luncheons and dinners. The newspaper devoted a large amount of space to his visit with illustrations.

Determination to place the Spokane municipal aviation field at Parkwater in line with the best fields in the Northwest was expressed subsequently in a discussion of aviation by members of the city park board. Commissioner J. C. Argall, who formed part of the air board that attended Rear Admiral Fullam, reported that the admiral was favorably impressed with the Spokane field and promised development of aviation in a commercial way if Spokane got in line with other cities making a strong bid for aviation centers.

Adoption of rules to govern the air was delayed until after action is taken by the National Aeronautical Society at its convention in September, when nation-wide flying rules are to be adopted in conjunction with the army and the navy. Temporary rules will be adopted to govern flyers using the Parkwater municipal field this year. It was voted to make the fee for the season \$5 a ship and to have the permit revocable by the park board at any time. All permits are to be issued subject to such rules as the board may adopt.

Personal Par

Arriving on the S.S. Pan America of the Munson Steamship Line from Rio de Janeiro on June 15th was Orton Hoover, Mrs. Hoover and their little daughter.

Mr. Hoover was formerly a Captain in the U. S. Army and is in charge of aviation at the Brazilian Exposition. He reported having just sold forty-two Curtiss airplanes to the Brazilian Government.



The Giant Johan with aviator Horchem and his wife standing under his outstretched arms, in front of the Laird Swallow in which Horchem took Johan for a flight, under a wing that with the giant in the cockpit the Swallow would never get off the ground. However, at the end of five minutes they had climbed to an altitude of fifteen hundred feet, a most remarkable feat for a ship the size of the Swallow, considering the load. Johan is 24 years old, is 8 feet, 9 1/2 inches tall, wears a 22 1/2 size collar and a number 20 shoe, weighs 503 pounds

The AIRCRAFT TRADE REVIEW

Automobile and Aircraft Manufacturers Launch Export Campaign

New York.—A united campaign to sell American automotive transportation to the world was begun to-day on the departure from New York of Gordon Lee, Chief of the Automotive Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, who during the next two months will make a nation-wide tour, visiting a score or more cities.

Mr. Lee and Major Horace M. Hickam, representing the Army Air Service, who flew to New York from Washington, addressed a conference of automotive manufacturers at the Transportation Club. The conference was attended by representatives of the National Automobile Chamber of Commerce, Motor and Accessory Manufacturers' Association, Aeronautical Chamber of Commerce, Automotive Equipment Association, Motorcycle and Allied Trades Association, National Association of Engine and Boat Manufacturers, Association of Automotive Equipment Manufacturers, the Class Journal Company, and The Black Decker Mfg. Co.

The campaign embraces the development of the foreign market for American constructed automobiles, motor trucks, aircraft, motorcycles, and motor boats. Mr. Lee expects to fly between many cities on his trip.

Congress of Aviation Matters in Congress

The following memoranda concerning progress of aviation matters in Congress have been prepared by the Aeronautical Chamber of Commerce:

April 12—House

Mr. Sisson discusses the Navy Bill (H. R. 11228). He believes the battleship dead and has been supplemented by the aeroplane. He believes that the nation that controls the air controls the sea and the nation that controls the sea controls the world.

May 2—House

Mr. Oldfield: A bill (H. R. 11515) providing for the purchase of certain inventions, designs, and methods of aircraft, aircraft parts, and aviation technique of Edwin Fairfax Naulty of New York; to the Committee on Appropriations.

May 8—House

Conference report of the Post Office Bill (H. R. 9859) submitted. In amendment No. 40, \$1,900,000 is provided for air mail service.

May 9—House

Brief filed with the Department of Justice by the Contract Audit Section of the Air Service in the Lincoln Motor Case printed in the record.

May 13—House

Post Office Bill (H. R. 9859). Appropriation of \$1,000,000 for air mail passed House.

May 15—House

Discussion of aircraft contracts in the consideration of H. R. 11645 a bill providing appropriations for the prosecution of the war contracts.

May 17—Senate

The Vice-President laid before the Senate a communication from the Secretary of War, transmitting in response to S. Res. 266 information relative to a school of aeronautics; which was referred to the Committee of Military Affairs.

House

Mr. Hicks in H. R. 11214, a bill authorizing the President to scrap certain vessels in conformity with the provisions of the Five-Power Naval Treaty, urges the converting of two battle cruisers into aircraft carriers.

May 20—House

Mr. Jefferies of Nebraska: a bill (H. R. 11723) to authorize and provide for payment of amounts expended in construction of hangars and maintenance of flying fields for use in the Air Mail Service of the Post Office Department; to the Committee on Post Office and Post Roads.

May 27—House

Mr. Hicks unanimous consent to lay on the table H. R. 5219, a bill to create a Bureau of Aeronautics in the Department of the Navy, and the Bill H. R. 6297 authorizing the construction of an aeroplane carrier for the Navy of the United States.

May 31—Senate

Vice-President laid before the Senate a communication from the Acting Secretary of the Navy, transmitting in further response to Senate Resolution 266, agreed to April 5, 1922, information relative to the establishment of an academy of aeronautics at the Naval Academy and the manufacturer of aircraft at naval stations, etc., which was referred to the Committee on Naval Affairs and ordered to be printed.

June 2—Senate

War Department appropriations (H. R.

10871). Aircraft appropriations amendments agreed to. Amendment allowing \$400,000 for Helium experimentation reduced to \$300,000 and agreed to.

To Study Plans of JR-1

Washington.—A special committee of leading engineers and structural experts appointed by the National Advisory Committee for Aeronautics met in this city May 18 to make a complete and thorough study of the Navy's giant airship ZR-1, as requested by Rear Admiral William A. Moffett, Chief of Naval Aviation.

The committee is composed of Henry Goldmark, a consulting civil engineer of New York, who was responsible for the design of the great steel lock gates of the Panama Canal; William Hovgaard, professor of naval architecture at the Massachusetts Institute of Technology, Boston; W. Watters Pagon, a consulting civil engineer of Baltimore, and an expert on bridge and structural steel work; Dr. L. B. Tuckerman, engineer-physicist of the Bureau of Standards, who was connected with the tests of the full-sized structural parts of the ZR-1; and Dr. Max Munk, technical assistant of the National Advisory Committee for Aeronautics and an expert on aerodynamics.

At a recent meeting of the National Advisory Committee for Aeronautics, Admiral Moffett, a member of the Advisory Committee, requested that a detailed technical study of the plans for the Navy's first fleet airship, parts of which are now being fabricated, be made by a special committee to check the plans as prepared by naval designers. Accordingly, the Special Committee on Design of Airship ZR-1 was organized by Dr. Joseph S. Ames, chairman of the Executive Committee, and instructed to make a thorough investigation and prepare a report. The object of the report is to pass upon the design and calculations, including the method of determining the load factor and factors of safety used in the design submitted by the Naval Bureau of Aeronautics.

It is estimated that the special committee will require ten to twelve weeks to complete its work and submit report to the National Advisory Committee for Aeronautics.

Seventh Corps Association

The Commercial Aeronautical Association of the Seventh Corps Area has had its Constitution and By-Laws printed in a neat booklet, which will be supplied to anyone interested on applying to Ralph W. Cram, Davenport, Iowa, president, or John B. Coleman, Sioux City, Ia., secretary. The association is organized to promote the interests of aviation, the location of landing fields and to do everything possible for the development of commercial aviation in the eight states comprising the Seventh Corps area. It expects in September to become a district of the proposed National Aeronautical Association to be organized at Detroit.

Aircraft Appropriations

	Allowed in Budget	House	Senate
Army Bill—H. R. 11228.....	\$17,043,310	\$7,866,950	
Navy Bill—H. R. 10871.....	15,210,770	12,431,000	*\$13,000,000
Post Office Bill—H. R. 9859.....	2,200,000	1,900,000	1,900,000
Post Office Adv. Comm. Aero.—H. R. 9981....	250,000	210,000	210,000

* Still under discussion. The helium appropriation has been cut from \$400,000 to \$300,000.

No appropriation bill has been signed as yet by the President. The Army and Navy bills are being held up in the Senate on account of the tariff bill. The other bills are in conference committees or the conference reports of these committees are waiting for approval of Congress before going to the President.

The Navy Bill was reported by the Senate Committee June 10th, 1922. This Report increased the appropriations for aircraft to \$14,703,950.

THEORY OF THE SLOTTED WING*

Lecture by A. BETZ, Göttingen

THROUGH the intensive study of all technical aviation problems during the war, the most important aeroplane parts, especially the wing, were so thoroughly tested as to create the impression that no further substantial improvement was possible. The characteristics of the different wing sections were sufficiently known to enable one to select the most suitable section for almost any purpose.

Then the discovery by Lachmann and Handley Page suddenly revealed entirely new possibilities and the wing section again became a rich field of problems. As probably you all know, this discovery consisted in making one or more slots in the wing section (Fig. 1). In this way it is possible to use the wing at higher angles of attack and thus considerably increase the lift. The lift-drag ratio, however, seems to be no better in general than for ordinary wing sections. The advantage lies principally in the ability to vary the coefficient of lift, and hence the speed, within considerably wider limits. Hereby the difficulties of taking off and landing are diminished and greater flight speeds made possible. Our knowledge of the behavior of such slotted wings under the most diverse conditions is, unfortunately, very limited, and there is still much work to do before we shall have carried our investigations so far as to be able to choose, from the many possible modifications, the one best adapted for any given purpose.

The question of the most practical importance is what must be done in order that with an aeroplane we can obtain the best possible lift-drag ratio if the lift-coefficient is low and, in addition, be able to reach by easily made changes, a considerably higher coefficient of lift, where the lift-drag ratio does not need to be especially good. The former condition would be used in ordinary horizontal flight and the latter in taking off or in landing. The purely experimental solution of all the problems connected with these new wing sections is rendered very difficult by the large number of possible modifications. The most diverse cross-sections may be given the component parts of the wing and their relative size may be varied, thus bringing the slot nearer either the leading or trailing edge. Furthermore, the relative position of the parts and the width of the intervening slot may be varied. Lastly, there is the possibility of varying the number of the component wing-parts by the introduction of one or more slots. Although, for structural reasons, many forms do not come into practical consideration, the number of possibilities is still very large.

The experimental work will be considerably simplified and rendered more productive of results, if we succeed in obtaining at least an approximate idea of what takes place. We are still, however, far from being able to give a complete theoretical explanation of the phenomena of slotted wings. Nevertheless, we can contribute something toward the explanation of the unusual increase of the lift coefficient. I do not wish, however, to create the impression that what I am about to say is conclusive. I wish rather to bring the matter

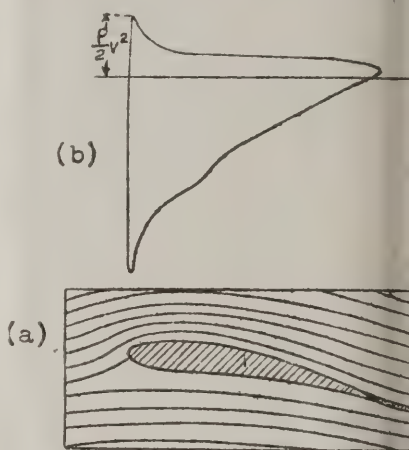
up for discussion, in the hope that still other viewpoints may be presented, which will help to clarify the problem.

We must first consider the question as to how it happens that, with a given wing section, the lift coefficient cannot be increased at will. In order to answer this fundamental question, we must consider more carefully the process by which lift is generated. It is known that lift is produced by the greater velocity, and consequently smaller pressure, of the air on the upper side of the wing, than on the lower (Fig. 2.). This difference must vanish at the trailing edge, around which the pressures can become equalized. The difficulty lies in the fact that a strong suction must be generated on the upper side, only to vanish again at the trailing edge. From the point of least pressure on, the kinetic energy of the air must therefore be transformed into pressure by a gradual increase in the cross-section of the tubes of flow. There accordingly takes place, on the rear portion of the upper side, a phenomenon very similar to the flow through a widening tube.

Now, it is known that such a flow, in which kinetic energy is transformed into pressure, remains stable only for a very gradual increase in the size of the cross-section. If the diameter increases too rapidly, the air does not continue to flow smoothly along the wall, but separates from it and goes its own way as a free jet, and the increased pressure is not obtained. If we increase the angle of attack of an aeroplane, the cross-sections of the tubes of flow on the suction-side are increased; and if a certain figure is exceeded, the air no longer flows along the upper surface of the wing, but is torn off, as it is expressed. This phenomenon is shown by Figs. 3 and 4. (The photographs were made by Dr. Heis and published in Prof. Prandtl's report on the Göttingen Aerodynamic Laboratory, in the Year Book of the Air Traffic Association, 1912-1913.) The first picture shows a wing having a normal angle of attack. The flow conforms quite

well to the top of the wing and is seriously affected by the small vortices which cover the wing. With larger wing and greater velocities, the vortices are probably still smaller. The second picture shows the same wing at a somewhat greater angle of attack, in which case the fluid no longer follows the top of the wing.

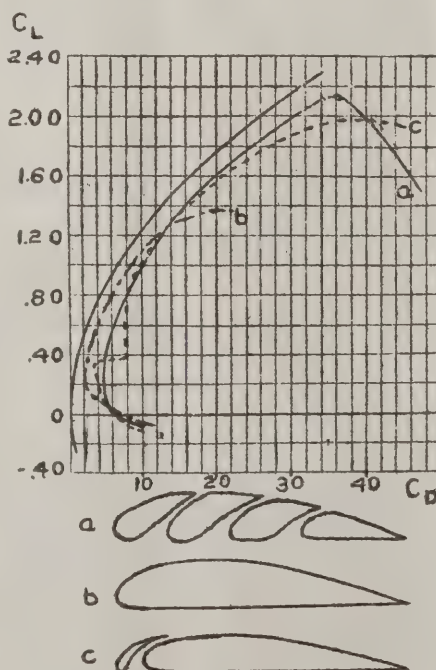
Involuntarily we now ask how it happens that the air does not separate on even a moderate increase in the diameter of cross-section. The explanation lies in the viscosity of the air or, in most cases, more correctly, in an apparent viscosity, which in turbulent phenomena, is conditioned by the turbulence itself. The cause may be pictured qualitatively as follows:



fluid has a tendency, on account of its inertia, to flow straight ahead, instead of following the curved surface, but there must exist, between it and the surface of the wing, a quiet or an eddying "dead water" region. This "dead water" is carried along by friction (or the effect of viscosity) and must be constantly replenished (Fig. 4). Now, when the viscosity is great that, in a given time, more fluid is carried away than can flow in, the "dead water" disappears and the flow follows the surface of the wing (Fig. 3).

Such are the general outlines of the phenomena which produce lift and which limit its magnitude. Unfortunately the phenomena cannot be treated quantitatively by theoretical methods. We must therefore content ourselves with qualitative illustrations and will now endeavor to explain, on this basis, the action of the slotted wing.

For the sake of simplicity, we will assume that there is only one slot. Such a wing section may be imagined as a biplane with a very great positive stagger and a very small distance between the wings. Some justification for this conception proceeds from the fact that, even with ordinary biplane, the maximum lift is increased by a positive stagger. According to biplane measurements published by myself in the fourth volume of "Zeitschrift für Flugtechnik und Motorluftschiffahrt" the maximum C_L without stagger was 106, with a positive stagger of 30° it was 116, and for one wing alone it was 106. Similar results were also obtained in England (Technical Report of the Advisory Committee for Aeronautics, 1915-16, Rep. Sect. II). Though the differences are



* Reprint from "Berichte und Abhandlungen der Wissenschaftlichen Gesellschaft für Luftfahrt" (Supplement to "Zeitschrift für Flugtechnik und Motorluftschiffahrt"), No. 6, January, 1922.

at, they would evidently be greater, if stagger were increased and the interval between the wings diminished.

We will first consider only the front wing and discuss how its characteristics are affected by the rear wing. From the theory of the biplane, we know that the flow is deflected obliquely upward. This affects the lift-drag ratio, but not the maximum coefficient of lift, which here alone interests us.

We also know that, at this point, the flow forms a curve with the concave side toward the rear wing. By increasing the camber, the maximum lift may actually be increased, though only to a very limited degree and at the expense of the lift-drag ratio. The rear wing is similarly affected by the curvature effect. It may therefore be assumed that the influence of the curvature of the flow plays a role of some importance with a given wing section with a moderately large camber, but nothing further is thereby gained than would be obtained by a larger camber. The extraordinarily large increase in the maximum lift cannot therefore be thus explained.

The following consideration may be of some importance. The front wing lies in a region of increased velocity. Now, since the force of air is proportional to the square of the velocity, it is evident that the lift on the front wing is thereby considerably increased. This argument has one exception, namely, that the reverse is true of the rear wing, so that for the combination of the two wings the two effects neutralize each other. In calculating the relations for an unstaggered biplane, we even obtain a smaller maximum lift than for the two wings alone and this result is confirmed by experiments. The relations are, however, somewhat changed by staggering. We must go into this more thoroughly.

We will first consider the arrangement of two wings of about the same size in which the relations stand out the clearest. The front wing, taken alone, would have a pressure distribution somewhat as shown by the fine line on the left of Fig. 5. Now, we bring the rear wing, which has about the same pressure distribution by itself, into proximity with the front wing, the trailing edge of the latter will lie in a region of great velocity, and correspondingly small pressure, produced by the rear wing. The leading edge of the front wing, on account of its greater distance from the rear wing, lies in air that is much less disturbed and consequently in a region of nearly normal pressure. The leading edge of the front wing is, accordingly, not so much affected by the pressure on the rear wing, while the pressure on the trailing edge of the front wing is diminished. We may therefore obtain, for the front wing, a pressure distribution corresponding somewhat to the dash curve in Fig. 5.

Through this modification of the pressure curve, the pressure increase on the suction (upper) side becomes much flatter. On the other hand we know that the limit of the lift is determined by the steepness of the pressure curve. It is therefore evident that we may now further increase the angle of attack, until the inclination of the pressure curve again reaches its limit (heavy line in Fig. 5). Since the velocity has become greater everywhere, the pressure curve may climb steeper than before.

It is obvious, the lift, which is represented by the area inclosed by this curve, has become considerably greater.

Let us now turn our attention to the rear wing. Here we find corresponding phenomena. The front wing produces on the leading edge of the rear wing a decrease in velocity and a consequent decrease in the



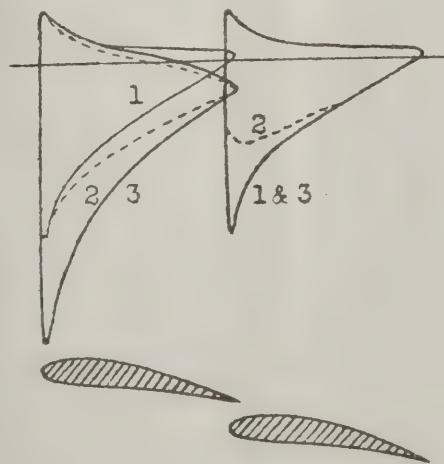
Fig. 3. Flow about a wing section at an angle of attack of 8° .



Fig. 4. Flow about a wing section at an angle of attack of 19° .

pressure diminution or suction. The trailing edge remains practically unaffected. Thus we obtain here, near the leading edge and mainly on top, an increase in pressure. The strong suction (or negative pressure) is diminished, so that here also there is a flatter pressure increase, as shown by the dash line. By increasing the angle of attack, we return approximately to the original curve, while the lift of the rear wing remains practically unchanged. Hence, in this combination the two wings produce a greater maximum lift than when separate, the gain being principally on the front wing.

The phenomena described will perhaps be more intelligible if we take for comparison the perfectly analogous phenomena of a simple and a compound Venturi tube. Fig. 6 shows a double Venturi tube, such as is often used on aeroplanes for measuring air speed. If we first imagine the small inside tube removed, we have a simple Venturi tube. The air flows through the constricted section with increased velocity and correspondingly diminished pressure. In the diverging cone behind it, the kinetic energy is again largely transformed into pressure, so that at the rear end, the external and internal pressures are again equal. Exactly the same causes which limit the lift in a wing, here make it impossible to obtain, by narrowing the throat, a pressure diminution of any desired value. In this case, however, it has long been known how to in-



crease the suction by a suitable combination of tubes. Such an instrument is shown in the figure. The exit of the inner tube is at the point where a diminished pressure is already produced by the outer tube. The latter now forms the starting point for the further pressure diminution in the inner tube, just as in the case of the front part of the slotted wing section, which we have already considered.

We assumed in our discussion that the two parts of the wing were of about the same size. In practice, however, the front part is usually much narrower than the rear part. Our assumption that the pressures on the leading edge of the front part were not noticeably affected by the rear part, no longer holds true. Here the whole of the front section lies in a field of increased velocity and is thus able to produce a greater lift, since the lift is proportional to the square of the velocity. For the rear section, however, our previous remarks hold good. The disturbance due to the front section is felt principally on the leading edge, which therefore has approximately its normal lift. Accordingly, we even here obtain increased lift for the whole combination.

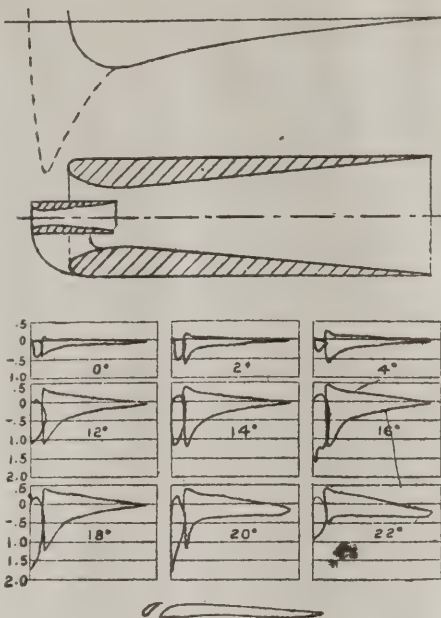
That the actual pressure distribution is approximately as described, follows from the data published by Handley-Page in "Engineering," March 4, 1921. These data are given in Fig. 7. For small angles of attack, the rear section shows about normal lift distribution. The auxiliary wing in front gives only a small lift, since its angle of attack is much too small. Only from 12° up does the lift of the auxiliary wing show any considerable increase, while the pressure distribution of the main wing remains almost the same. The increased suction on the trailing edge of the auxiliary wing is also evident. At about 20° , the flow separates from the main wing and the lift of the auxiliary wing diminishes.

The above conception of the phenomena renders the occurrence of an increased lift coefficient somewhat more comprehensible and even offers the prospect of making it possible to compute the relations. On the other hand, the following consideration may be presented. If the slot is continuously narrowed, the arguments pointing to a higher maximum lift continue to hold good, but the phenomena vanish when the slot is closed altogether. This was to be expected from the first, since the wing is transformed by closing the slot into one of a practically normal shape. In any event, a slot of a certain minimum width is essential. Since the theory just presented, says nothing about this, the phenomena must also be considered from a different standpoint.

In explaining the phenomena of lift production, I called attention to the fact that the clinging of the air stream to, or its separation from, the upper surface of the wing depends on whether the dead air is carried off fast enough. When we consider this phenomenon on the rear section of a slotted wing, it is obvious that the work (which may be called pump-work or suction) must be performed at the expense of the kinetic energy of the thin air stream flowing through the slot. If the latter is made too narrow, the ribbon of air finally becomes so thin that its kinetic energy no longer holds out to the trailing edge of the rear section, but is, itself, transformed into dead air by mixing with the dead air above and below it. When considered from this standpoint, the phenomena of the slotted wing appear in quite another light. We can now think of this wing section as an entity, derived from an ordinary wing section by connecting its upper and lower surfaces by slots, which is, in fact, the con-

ventional conception. The slots convey new energy to the marginal layer of air retarded by friction on top of the wing, thereby increasing its velocity and thus preventing the accumulation of dead air. The air stream flowing out of the slot acts like the jet from a syringe and reinforces the air stream on top of the wing in carrying away the dead air. Since the production of lift depends on the efficiency of this pump-work and the maximum lift is conditioned by the limited possibility of carrying off the dead air, it is apparent that any increase in the pumping efficiency increases the maximum lift.

We are now inclined to ask which of these two theories is the right one. The answer is that both are equally correct, since they both explain the same phenomena, but from different standpoints. We should rather ask which viewpoint is the more practical. To this question I would reply that we have use for both, according to what we wish to learn. The conception of the slotted wing as a biplane whose wings mutually influence each other has the advantage of enabling computation to a certain extent. With its help, we may succeed in constructing formulas which will



enable the determination, in some measure, of the quantitative relations. The second viewpoint is essential, when it is desired to form an idea of the requisite width of slot. I would add a word of warning against too great optimism. The relations are much more complicated here, than, for example, in the theory of the monoplane biplane. Much work must still be done before these theories are developed into practical rules. With the limited data now available, much time will be required for this work. The immediate task is to determine whether the theories just presented really explain the essential features of the phenomena, or whether other circumstances of decisive influence will come in. This cannot be conclusively determined from the experimental data now available. If the theory, however, agrees with the facts, this is already a great gain, even though we do not succeed in working out convenient computation formulas. We know, at least, what the essentials are in obtaining the right shapes and can thus save ourselves much useless work.

(Translated by the National Advisory Committee for Aeronautics.)

ELIAS & BRO. PUT NEW COMMERCIAL PLANE ON MARKET

G. ELIAS & BRO., INC., of Buffalo, New York, on May 17 were awarded a War Department contract for two experimental machines of their design for a Type 12 Bomber, which was pronounced by the Department as the best plans submitted for the type specified. The Elias Company have received several awards for designs, notably these: June 1st, 1920—\$3,000 prize for contract for three machines of their design for Air Service training planes; November 30th, 1920—\$4,500 prize for the best three-seater multi-motor machine; June 28th, 1921—second prize for a ship-board plane, \$10,000 by the Navy Department; August 2nd, 1921—\$3,000 award for two-seater night observation plane.

Aside from these activities, G. Elias & Bro. have produced for the commercial market the Elias-Stupar aeroplane E-S-1 (biplane). It has 5 seats, including that of the pilot. It is designed to meet all requirements for commercial work; and the cost of operation is estimated to be 3.2 cents a passenger mile, with baggage; or 5 cents a passenger mile without baggage. Its cruising range with full load is 400 miles. There are 46 cubic feet of cargo space, with 14 cubic feet additional if necessary.

The following are approximate figures of cost of carrying cargo per 100 miles, based on an assumed distance of 300 miles between terminals:

Fuel and Oil..... \$ 9.00
Pilot..... 2.50
Upkeep (mechanics, spare parts, etc.)..... 11.00

Overhead (rental of field, telephone, office assistants, etc.) Based on a route where 5 machines are in use. 8.00
Depreciation and Insurance..... 2.50
Cost of transporting 1,000 pounds 100 miles..... 32.00
Cost per pound per 100 miles..... 3.2c

Other specifications are:

Spread34 ft. 5¾ in.
Length24 ft. 4 in.
Height (tail on ground)..... 9 ft. 4 in.
Height (fuselage level)..... 9 ft. 8 in.
Total Wing Area (including ailerons)385 sq. ft.
Aileron Area..... 51 sq. ft.
Horizontal Stabilizer 20 sq. ft.
Vertical Stabilizer..... 7 sq. ft.
Elevators 25 sq. ft.
Rudder 14 sq. ft.
Gap 5 ft. 6 in.
Chord 5 ft. 6 in.
Gap Chord Ratio..... 1 to 1
Dihedral between motors..... 0°
Dihedral overhang 2°
Angle of incidence relative to center line of propeller shaft..... 3°
Angle of incidence with tail skid on the ground17°
Power2-80 h.p. LeRhone Motors160 h.p.
Fuel capacity 86 gals.
Oil capacity 12 gals.
Seating capacity 5
Baggage space—in addition to passenger compartments 10 cu. ft.
Total cargo space when no passengers are carried..... 46 cu. ft.
Weight, empty.....1569.52 lbs.

Non-pay useful load, consisting of:
Students control..... 4.50
Cushions, except pilot's 36.69
Safety Belts, except pilot's 6.00
Fire Extinguishers.... 20.00
Gasoline (3 hr. supply) 360.00
Oil (3 hr. supply).... 72.00
Pilot 162.00

Total 675.88
Pay load..... 955.60

Total useful load..... 1631.48

Total weight of machine fully loaded..... 3200.00

Light load (definition)
Minimum weight of machine for one-half hour flight, consisting of:

Weight of machine empty1568.52
Pilot 160.00
Fuel for one-half hour 60.00
Oil for one-half hour.. 12.00

Total 1800.52

Wing loading, light load (1800 lbs.).....4.80 lbs. a sq.

Wing loading, full load (3200 lbs.).....8.55 lbs. a sq.

High speed, light load..... 90 m.
High speed, full load..... 90 m.
Landing speed, light load..... 35 m.
Landing speed, full load..... 50 m.
Climb, full load..... 400 ft. per min.
Climb, light load..... 1000 ft. per min.

STABILITY OF AEROPLANES

By EDWARD P. WARNER

Professor of Aeronautics, Massachusetts Institute of Technology*

HERE is a very general misunderstanding about the amount of skill and natural aptitude required for flying an aeroplane. One often finds an impression among persons not directly associated with aeronautics or in a position to be kept informed of advances in that science that the operation of an aeroplane is somewhat analogous to walking a tight rope, and that the piloting of such machines is possible only for those who have the natural aptitudes of the trick bicycle rider or the aerial acrobat. As a matter of fact, of course, flying is extremely easy. In many ways it is easier than driving an automobile, and any sound person can learn to fly at least fairly well, if not to be a pilot of exceptional skill.

The popular misconception regarding the difficulty of flying arises largely from the belief that the aeroplane is an essentially unstable vehicle and that it is continually watching for a chance to get out of equilibrium and hurl its unwary pilot to his doom. While such strictures might have been justified, at least to a slight extent, in connection with some of the early aircraft, there is no reason for them now, as the modern commercial or touring aeroplane is extremely stable and steady in flight. It not only does not deliberately depart from its normal course but even resists any attempt to make it do so. In fact, some aeroplanes are so stable that pilots object to them on the ground that it is impossible to make them fly in an abnormal position when that is necessary for the purposes of a particular maneuver.

Automatic Pilots

Such stabilization does not require the use of any elaborate mechanical device. In the early days of flying all sorts of schemes, most of them involving pendulums and gyroscopes, were proposed and tried and some succeeded very well in stabilizing the aeroplane or at least in exercising the functions of the pilot, relieving him of the duty of operating the controls. It could be emphasized, however, that the mechanism merely operates the controls, and that no such thing as a true stabilizer, operating directly on the aeroplane as a gyroscopic stabilizer as on a ship, has yet been produced. A real stabilizer, at least if it were of the gyroscopic type, would be far too heavy to be carried in flight. Some of the devices for keeping an aeroplane on an even keel are already described by their inventors as automatic pilots or mechanical pilots, rather than as stabilizers, and it would be well if the same terminology were spread to all the other cases.

No automatic pilot has gained any real wide measure of favor. The difficulty of piloting is not great enough to require the intervention of any new devices, especially since they do not relieve the pilot of his most difficult task, that of making a landing. Pilots have a natural distrust of any new mechanism and hesitate to permit the introduction of an instrument, the multitudinous gears and levers hidden away from inspection, on whose continued perfect functioning the pilot's life must hang. They far prefer to depend either on their own skill and watchfulness or on the natural stability of the aeroplane secured by its form and disposition of its rigid parts.

Stable Designs

A skillful pilot can fly an unstable aeroplane successfully. Aside from this fact, however, there really is no need for elaborate mechanisms such as are frequently produced, as it is

not difficult to make any desired degree of stability inherent in the aircraft, arising from the very design of the machine. In fact, the point has been reached where it is possible to lay down a few simple rules which suffice to insure stability, at least in longitudinal motions. To prevent pitching and to insure that it will not attain a dangerous magnitude is far easier than to prevent the aeroplane becoming unstable in roll. Although the most uncomfortable oscillations of an aircraft are those in pitch, the aeroplane being unlike a ship in this respect, there is little danger from such oscillations if the slightest attention was given to stability in the design.

Stability in roll, however, and the securing of directional stability, or the tendency to maintain a straight course and to resist any tendency to go into a turn, are much more difficult to secure and the problems connected with them are not yet fully understood. The most frequent cause of accident is still the spin, a particular form of lateral instability. Aeroplanes have been built which were "spin-proof," which would never assume a spinning attitude of their own accord, but the means by which that much to be desired characteristic was obtained are not yet clear enough to make possible their certain duplication on another design.

Reliance in Mathematics

The study of stability and its improvements on given types of aeroplanes is one of the most important in connection with which further study is required. Development in this direction can come only through the enthusiastic cooperation of the aeroplane designer, the experimenter in the laboratory or in free flight, and the mathematician to whom the theory of the subject is due. It cannot be too strongly emphasized to those who do not already know it that the whole procedure in designing stable aircraft is based on a mathematical theory originally produced by pure mathematicians and physicists, some of whom had never had the slightest experience in flight. That it is now possible to produce an aeroplane which can be flown for long periods without touching the control is due largely to the genius and patient labor of Professor Bryan and Dr. Leonard Bairstow and others in England and of Prof. E. B. Wilson and Commander Hunsaker and their co-laborers in other countries.

Mathematical analysis alone, of course, does not suffice, and the practical application of mathematics must rest on data obtainable in part in the wind tunnel or laboratory, in part only in flight. The most effective check on any deductions regarding stability is obtained by making a succession of changes in an aeroplane and actually observing the effect which they produce on stability. Such work has been and is being done by the Royal Aircraft Establishment in England and by the National Advisory Committee for Aeronautics here, and on it no less than on the labors of the mathematician the production of safe and stable machines in the future must rest.

The final problem is to secure the devoted cooperation of the aeroplane designer. It is a lamentable fact that there yawns too often a wide gulf between the "theorist" and the "practical man," a gulf across which each party regards the other with scorn. The problems are too great to permit of any dissension as to who shall work on them, and the best results will be obtained only when the designer makes full use of the work of the experimenter and the mathematician and when those individuals of more theoretical bent carry on their labors with the actual practical needs of the designer constantly in mind.

AMERICA READY FOR AIR TRAVEL

AT the ninth bi-monthly luncheon of the Aeronautic Executives, held at the Cafe Boulevard, New York, May 8, Major B. L. Smith, General Manager of Aeromarine Airways, Inc., proved conclusively that there was adequate and efficient aircraft equipment at present in operation in this country to operate extensive air routes throughout the U. S. if public interest was sufficiently aroused.

In introducing Major Smith, Chairman R. Blythe stated that the Major was a pioneer naval aviator who had been flying since 1911. It was through his efforts, to a very great extent, that a branch of Naval

Aviation was organized in America. During the war Major Smith won high recommendations from the Allied Air Forces for his efficient organization and operation of naval aircraft.

In the operation of the Aeromarine Airways between Key West and Havana and the Nassau-Bimini-Miami route there was a total number of 747 flights made over a period of six months, during which time there was carried 2,700 passengers and 10,800 pounds of freight.

"Of course, I am very enthusiastic about the results of our Southern operations, and aided us in making this very favorable

owing to the fact that the tourist season record, we expect next year to even exceed the number of passengers and freight carried by a large percentage.

"The fact being that the public now realizes that there is a very much improved service between Key West and Havana which eliminates the eight-hour steamship trip across the 97 miles of open, and very often rough, ocean. This trip is made by air in one hour and fifteen minutes.

"During the 2,100 flying hours in the South," said Major Smith, "we have proved conclusively that commercial aviation is safe and that a commercial aircraft com-

*Taken from *The Christian Science Monitor*.

pany can be operated at a profit. One of our F5L's, the 'Ponce de Leon,' during two months made over 100 miles daily, and every third day completed a round trip from Key West to Havana, a distance of 200 miles. There were no accidents, but one wing tip pontoon was lost, the cost of replacement being about \$148.00.

"We have operated through all kinds of weather and have a record of only three interrupted flights during our total season of operations.

"For a commercial seaplane there is not today a safer, more durable or commodious plane than the F5L. It is strong enough and sufficiently seaworthy to ride on the buffeting ocean waves which would swamp and sink a smaller plane.

"During the operations of these boats we have had the Santa Maria in the water as long as nine months. Even after the trying 7,000-mile flight last summer from Key West to New York over the Great Lakes to Chicago, down the Mississippi to New Orleans and back to Key West through many varying temperatures, the highest being 103 degrees in the shade, we had only

to recover the wings and make some small paint retouching to the hull and tail section. The maintenance cost is extremely low on this type of plane. Of course, much of this is due to the care in operation and handling.

"Docking after flights presents most causes for injury to the craft, due to missing the mooring and drifting into the wharf or bumping the wings and hull. Even this feature is not serious, because the total costs for damage caused in docking would not amount in six months to sufficient to increase our regular pay-roll or supply orders.

"On July 1 we begin operations of a round trip daily between New York and Atlantic City with a 14-passenger flying boat, making this trip in 1 hr. and 15 minutes. This plane leaves 79th Street and Hudson River at 4:00 p. m.

"We will also inaugurate on the same date our Cleveland-Detroit daily service, making the trip in 90 minutes which takes 7 hours by rail."

Major Smith referred to the lack of public patronage of aerial transportation by

the brief statement that the publication of the crash of the London-Paris aircra featured in the Sunday papers decreased the gross income for passenger flights the same day exactly 100% over the previous daily income.

"I am sure that if we only were given the publicity in the newspapers which has been devoted in the past to feature crashes and had in their place stories of successful craft operation, we would today be in a position to give daily air service anywhere in the United States for those who wish to cut traveling time in half, and that by increasing patronage the rates charged, which now seem extremely high, would be in turn cut slightly in excess of that charged by railroads."

Among the aeronautic companies which have represented the Aeromarine Airways, Inc., Gallaudet Aircraft Corporation, Netherlands Aircraft Mfg. Co., Wright Aeronautical Company, Curtiss Aeroplane & Motor Corp., J. L. Aircraft Corp., Loening Aeronautical Engineering Corp., American Airways, Inc., and Johnson & Higgins, Aeronautical Insurance Brokers.

SYLPHON DIAPHRAGMS

A Method for Predicting Their Performance for Purposes of Instrument Design

By H. N. EATON and G. H. KEULEGAN

Bureau of Standards

Introduction

THIS technical note was prepared for the National Advisory Committee for Aeronautics as a part of the report on the "Investigation of Diaphragms for Aeronautic Instruments," and the purpose of this paper is to show that the characteristic performance of a sylphon diaphragm can be predicted from a knowledge of its stiffness and of its dimensions. The proof is based on a mathematical analysis of this type of diaphragm, together with enough experimental data to prove the validity of the assumptions and the sufficiency of the analysis. Equations are developed for the performance of sylphons under various conditions of loading, both for concentrated loads and for hydrostatic pressure.

The results of the investigation will be useful in the design of instruments or devices containing sylphons, since, by measuring certain dimensions of the diaphragm and the deflection produced by a known concentrated load (to determine the stiffness), the designer will be able to predict the action of the sylphon under the above-mentioned types of loading within the limits defined below.

The load-deflection curve of a sylphon is linear over a considerable range, and over this range the errors due to imperfect elasticity (i.e., drift, hysteresis, and after-effect)* have been found to be less than 1 per cent of the maximum deflection and so can be neglected, as far as the object of this paper is concerned. The discussion which follows is limited, therefore, to the range of loading for which the load-deflection curve of the sylphon is a straight line and does not include a consideration of

the effect of drift, hysteresis and after-effect.

Assumptions

The following assumptions will be made:

(a) The load-deflection curve of the sylphon for concentrated loads is linear. (This curve will be called the *characteristic curve* of the sylphon—see Fig. 2.)

(b) The errors due to imperfect elasticity (drift, hysteresis and after-effect) can be neglected.

(c) The external space between two successive corrugations is equal in volume to the internal space between two successive corrugations for deflections within the linear range.

(d) The cross-sectional area of the sylphon remains constant.

It has already been stated that assumptions (a) and (b) are warranted from experimental evidence. The range over which they hold good will be discussed later for a particular sylphon.

Assumption (c) is justified by the excellent agreement between results obtained experimentally and those obtained analytically by making use of this assumption. Assumption (d) is sufficiently accurate for the present purpose.

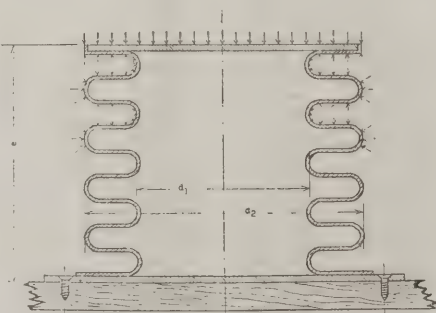


Fig. 1.

Notation

The following notation will be used:

L = concentrated central load.

P = difference of pressure between inside and outside of sylphon.

d₁ = internal diameter of sylphon. (See Fig. 1.)

d₂ = external diameter of sylphon. (See Fig. 1.)

y = deflection of upper face under load measured from neutral position upper face (i.e., under no load)

A = maximum cross-section perpendicular to axis

$$\left(\text{i.e., } A = \frac{\pi d_2^2}{4} \right)$$

A_q = equivalent area.

l = length of sylphon.

h = depth of one corrugation.

V = volume of the sylphon.

v = average volume of sylphon per unit

$$\text{length} = \frac{V}{l}$$

W = work done on or by the sylphon.

n = number of corrugations.

$$S_s = \text{spring stiffness} = \frac{L}{y}$$

$$S_c = \text{stiffness of sylphon for concentrated loads} = \frac{L}{y}$$

$$S_d = \text{stiffness of sylphon for distributed loads} = \frac{P}{y}$$

S = stiffness of combined sylphon and spring when hydrostatic pressure is supplied to the sylphon.

g = width of gap between spring and sylphon before being coupled together.

* These terms will be defined as follows:

Drift is the change of displacement under constant load.

Hysteresis is the excess of displacement with loads decreasing, over the displacement at the same load, with loads increasing.

After-effect is the residual displacement at any time after removal of the load.

Laws of Deflection

Equation (11) contains two constants, A_4 and S_0 , which depend only upon the characteristics of the sylvan. A_4 can be computed from purely geometrical considerations, but S_0 must be determined by

experiment. From a single deflection with a concentrated load it is possible to obtain S_e , provided care is taken that the range of loading for which the load-deflection curve is linear is not exceeded. It is also possible to determine A_q from a second experiment with distributed load, but it is usually preferable to compute the value of this constant from equation (9).

Performance

Suppose that a sylphon is distended by a spring either internal or external (see Fig. 4). The performance of the spring may be expressed by

$$(12) L = S_y y$$

Assume that, with the spring and sylphon mounted but not coupled together, there exists a gap g between the couplings. If the two are now coupled together, g is reduced to zero and the top of the sylphon is deflected an amount y_1 . y_1 can be computed from the known values of g , S_e , and S_s and, consequently, the reaction of the spring and the sylphon upon each other L_1 can be computed, as will be shown.

$$L_1 = S_{cy_1} = S_s (g - y_1)$$

$$(13) \begin{cases} y_1 = \frac{S_s g}{S_e + S_s} \\ g - y_1 = \frac{S_e g}{S_e + S_s} \end{cases}$$

and

$$(14) L_1 = S_{cy_1} = \frac{S_e S_s}{S_e + S_s} = g$$

Now let a pressure P be applied externally (or suction internally). Equating the force exerted by the spring to the elastic resistance of the sylphon and the load, there results

$$L_1 + S_y y = L_1 - S_{cy} + A_q P$$

where y is measured from the neutral position of the couplings when the sylphon and spring are coupled together.

Then (15) $A_q P = (S_e + S_s) y$ or

$$(15a) P = \left(S_a + \frac{S_s}{A_q} \right) y$$

The quantity in parentheses is the stiffness of the combination of spring and sylphon and (15a) may be written

$$(15b) P = S_y y$$

Four sylphons were tested in order that experimental confirmation of the preced-

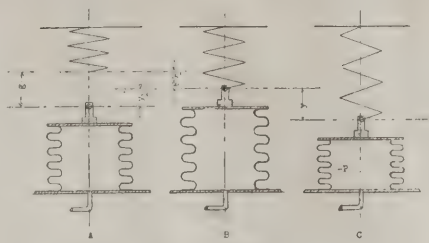


Fig. 4. Sylphon and spring in combination.

ing analysis might be obtained. The construction characteristics of these sylphons are given in the following table:

TABLE 1.

	No. 1	No. 2	No. 3	No. 4
Internal Dia....cm.	4.1	9.5	4.1	9.5
External Dia....cm.	6.0	11.9	6.13	11.6
Thick. of Mat....cm.	0.011	0.025	0.025	0.025
Number of Corrugations	11	10	12	21
Material (Brass)				

Fig. 2 shows the characteristic curves for these sylphons. The value of S_e can be obtained from these curves, since from

$$(1) S_e = \frac{L}{y}$$

Fig. 3 shows performance curves for Sylphon No. 2 determined experimentally. Extension and loads tending to produce extension of the sylphon are considered positive. The curves are linear over the range shown in Fig. 3. It was found that, when a load producing a deflection of -0.35 cm. was applied, the curve was no longer linear. The points in which the lines $L = \text{const.}$ cut the axis of deflections is obtained from the characteristic curve of the sylphon. The points in which these lines cut the axis of pressure may be computed from equation (11) by putting $y_1 - y_2 = 0$, when

$$P = \frac{L}{A_q}$$

or, if preferred, the lines may be drawn through the proper points on the axis of deflection with the required slope. This slope is easily proven to be $+S_a$ from equation (11). The slope appears to be negative in Fig. 3, but it should be remembered that the pressures shown here are negative.

Fig. 3 shows that Sylphon No. 2 will give linear load-deflection curves from a deflection of about -0.2 cm. to at least $+0.4$ cm. The positive limit of linear deflections may be much higher than $+0.4$

cm., but the tests were not carried to limit.

From a consideration of the way which the family of curves in Fig. 3 constructed, it is clear that each in section of a line $L = \text{const.}$ with the of pressures can be used to determine value of A_q . Considering such a point have the relation

$$A_q = \frac{L_1}{P_1}$$

This will be utilized to provide a check on the values of A_q as determined analytically.

TABLE 2.

Equivalent Areas of Sylphon.

SYLPHON No. 1.					
P	L	A	A _q	A _q %	
gms/cm ²	gms.	cm ²	cm ²	Experimental	Computed
4.32	91.0	28.3	21.1		
2.14	45.0		21.0		
1.07	23.0		21.5		
0.42	9.0		21.4		
Av.			21.25	73.4	

The difference between experimental and computed values is 2.4%.

SYLPHON No. 2.					
15.75	1361.0	111.3	86.4		
10.40	908.0		87.3		
5.00	453.0		90.6		
2.65	227.0		85.7		
1.55	136.0		87.3		
1.00	91.0		91.0		
0.45	45.0		100.0		
Av.			89.83	81.7	

The difference is 1.3%.

SYLPHON No. 3.					
64.5	1361.0	29.55	21.1		
44.0	908.0		20.6		
21.5	453.0		21.0		
10.7	227.0		21.2		
Av.			21.00	72.4	

The difference is 1.7%.

SYLPHON No. 4.					
26.0	2270.0	105.7	87.3		
20.8	1814.0		87.2		
15.3	1361.0		89.0		
10.2	907.0		88.8		
5.0	453.0		90.6		
Av.			88.58	83.4	

The difference is 0.5%.

The agreement between the experimental and calculated values of A_q indicates that the equivalent area for any sylphon is independent of the elastic properties of the sylphon and may be computed from the expression

$$A_q = \frac{\pi}{8} (d_1^2 + d_2^2)$$

METAL CONSTRUCTION

By Rodolfo Verduzio*

Director of the "Istituto Sperimentale Verduzio"

THE future development of aerial navigation is closely connected with the condition of obtaining aeroplanes of great stability and sufficient strength. Formerly, the science and technical knowledge of construction were deficient and the difficult problem of the necessary lightness for being supported by an element so thin as air was solved at the expense of the strength of the entire structure. This beginning, which has led to great and undoubted progress, has resulted in many accidents, and thus every advance has been accompanied by a series of mishaps. The

evolution of aircraft has been quite rapid, but not so rapid as human evolution. The technician obtained a slight structural improvement, which the pilot recognized, appropriated and utilized to its fullest extent, and then sought something better. At the same time, he became more skillful and bolder, and tested the aeroplane more severely, so that it often gave out because it lacked just what the hand that guided it required. Thus it became necessary to make aerodynamic modifications and structural reinforcements. Abstaining for the present from taking up the problem of aerodynamic progress, we will consider the problem of structural strength.

The coefficient of safety, that number which represents in all structures the ratio between the breaking strength of a material and the load or stress which it must sustain, was quite a small number for the first aircraft. The poor constructor struggled with his own ignorance and his lack of adequate means. His aeroplanes had neither suitable finish of form nor materials of suitable strength and lightness nor reliable engines, powerful and light. Hence they were heavy, clumsy, slow, and not very strong. But with the ill-adapted means, laws were determined, flights were made, and the course that was followed was outlined. Progress was made.

* Lecture delivered before the "Associazione italiana di aeronautica."

which, by gradually eliminating the defects due to ignorance, has reached its present state. This state is not the final condition, but simply a step to be used as the basis for still greater progress. Today the former modest coefficient of safety has been considerably raised, and is at least 10 for a swift aeroplane, and 6 or 7 for some parts of a good airship. These numbers, which have not yet been reached in most other kinds of construction, are not, however, the maximum limits for aeronautic construction. Pilots still demand much in the way of technical improvements.

The idea here promulgated seems contrary to the general opinion. How much more solid a house or a locomotive seems than a light aeroplane? How much more solid an automobile or a ship seems than a fragile airship! Nevertheless, the house, the locomotive, the automobile, and the battleship have no greater coefficient of safety than is required for the modern aircraft.

The need of a very high coefficient of safety resides in the nature of the aeroplane which, being balanced in the air, is capable of great acceleration from the application of great forces which necessitate coefficients greater than any hitherto obtained and which, for some aircraft, can technically assume such high values as to render their construction impossible. Able technicians are today trying to solve the intricate problem and some carry their conception to the point of claiming that the coefficient of solidity of some aircraft can be even a little higher than that of its pilot. Experiments have already been suggested for determining the coefficient of human stability, a coefficient which, for our satisfactions, we may consider from various indications as being quite high.

The very high value of the coefficient of safety now necessary demands the most accurate construction, worked out in its minutest details with materials of the very best quality—a construction which, in order to be light enough, must correspond perfectly to the theoretical conception and, in order that every part will function exactly as designed, every secondary stress must be eliminated and every harmful strain avoided. In general, for every flexure there is a corresponding adjustment favorable to the stability, at least when it is a question of a part being loaded to the point where any distortion indicates the beginning of excessive flexure with consequent collapse. But structures consisting of members loaded axially are ordinarily the lightest and are therefore preferred in aeronautics. Therefore every structure must, in general, be confined within the narrow limits indispensable for the length of the member involved. The distortions correspond to the moduli of elasticity and hence are of the greatest importance in selecting the materials to be used in aeronautics. It is not necessary to include all materials of great elasticity. The wood for propellers may be all the more desirable on that account, but with its low specific gravity, great strength, a high limit of elasticity and a high coefficient of expansion, there is generally considered a high modulus of elasticity.

After having thus characterized the mechanical properties of aerodynamic materials, we can immediately separate them into two categories. One category includes those employed in parts requiring continuity of material and which may consist either of a simple covering, or also at the time of a strong member. The other category comprises all materials especially adapted for strong parts. In this second category, on account of the mechanical properties

of the materials, there is found natural extrinsicality and perfect correspondence. In the first list, on the contrary, the condition of continuity makes itself imperiously felt and to this requirement there must often be joined that of flexibility. As things are now, we would be unable to imagine an airship not covered with fabric, or its car not covered with fabric or a thin layer of wood, but, if (aside from the specific case of the envelope of an airship to which we will shortly recur) we concede that the element of shape serves a purpose, we can best employ a covering without flexibility and we can imagine a car, a fuselage, or a wing not covered with fabric, but made of strong material or metal sheets.

The case of the airship is somewhat different from the examples just mentioned, on account of the enormous size of the envelope, which, in order to be strong enough, necessitates the concentration of certain stresses in strong members, which could not be distributed along the whole surface, so that although the resistance to the normal stresses would be possible theoretically, there would still be failures due to secondary and local stresses. The non-rigid envelope is flexible by nature and withstands the stresses by reason of the tension of the inclosed gas, which renders it sufficiently rigid since any force of compression at any point is always less than the pre-existing tension.

Aside from the canvas used especially for airships, the aeronautic materials which we may term non-flexible* and which are used in constructing the framework of aircraft, are: iron, with its binary and ternary alloys; aluminum with its alloys, and wood. To these must be added those which are used for bushings, supports, etc., but these materials, on account of their heavy weight are used in small quantities and only where they are indispensable.

Wood, aluminum, iron and alloys were not equally employed during this period in the various parts of aircraft. The progress in construction made in aeronautics before the war was due almost wholly to the iron and metal industries. These gave us the indispensable powerful and light engines. The first aircraft employed much steel, considerable aluminum and some wood. With the advent of the war there was a great and increasing consumption of metals in war materials, leaving little for aeronautics. This fact, together with the shortage of good mechanics, led to the extensive use of wood and the limitation of metal to those parts where it was found to be indispensable, all the more, because the disadvantages due to the conservation of articles of wood were not felt during the war on account of the necessarily rapid renewal of war material. The problem now has quite a different aspect. The commercial problem has come to the front, and aeroplanes, besides being safe, must be able to make long trips. Wood presents disadvantages possessed in only a small degree by metals: distortion, due to its low modulus of elasticity; excessive deterioration, from inclement weather; possibility of breaking easily from splitting; lack of homogeneity in density and strength, and ease of absorbing moisture, which diminishes its strength. Hence, as in all other construction wood has gradually yielded to metal, a like change is taking place in aircraft. It is well to remember that the advantage claimed for wood, of greater strength in proportion to its weight, no longer has any value, since I have already shown in a different article (in "L'Aeronautica," March, 1920) that

good steels, duralumin, and alloys are, even in this respect, preferable to the best woods for aircraft. We will now make a little closer study of metal construction.

Fully loaded parts not exposed to the wind.—Steel and, to a smaller degree, aluminum and duralumin tubes are suitable for small loads borne for comparatively short periods. Theoretically, this is shown by a formula which includes the thickness, diameter of tube and length loaded or stressed.

1. *The minimum thickness is determined by conditions of indeformability from secondary stresses.*—Both theoretically and practically it has been demonstrated that this minimum thickness is a function of the radius of curvature, and it appears that the minimum thickness should never be less than 1/20 of the radius of the cross-section of the tube. Under these conditions, we assume that we can adopt, for good carbon steels, or ternary steels of 50 to 60 kg. per sq. mm. breaking strength, a safety load of about 1/5 of the breaking strength, while for duralumin the safety load must be kept somewhat lower, probably about 1/7. When subjected to severe tests, such tubes have demonstrated the perfect agreement of the practical results with the theoretical deductions. In Fig. 1 are shown the distortion curves of several tubes which were tested, and it may be seen how little the values registered vary from the distortion curves.

These tubes are not strong enough, however, for great loads and lengths. In such cases recourse is had to complex construction with braced girders. The theoretical conception is simple, but the external construction assumes various aspects. Ordinarily (Fig. 2) three similar members are parallel to the axis of the compressed solid and are connected with one another in various ways, which give the various methods of construction. Thus the steel tubing girders of the first Italian airships were very similar to those used in the Zeppelins (Fig. 3). Not all the connections were suitably made and we improved the construction of the various joints, thus obtaining greater strength for the same weight, and giving us the steel girders (Fig. 4) of our present airships and the duralumin girders (Fig. 5). The principal difference between the steel and duralumin girders lies in their joints. For the former a good fastening with iron wire or tin solder (Fig. 6) answered the purpose, while the latter had to be joined with at least two rivets (Fig. 7), which necessitated the use of sheet metal members instead of tubes. Aside from the above mentioned manner of bracing, other methods have been employed with equally good results, as shown in Figs. 8, 9 and 10, representing both square and flat girders.

We also show here some results (Fig. 11) of breaking tests. Note how accurate the agreement is between the experiments and the theory. Every distortion could have been perfectly predicted.

(To be concluded)

*There are also elastic rubber cords which are used as shock absorbers and recoil springs.



NAVAL *and* MILITARY AERONAUTICS



Chief of Air Service Flies Over Capitals of Three States

By utilizing the airplane, General Mason M. Patrick, Chief of Air Service, was enabled to save several days' time in his inspection trip of fields in the 4th Corps Area. Air Service activities were inspected at Chapman Field, Miami, Fla.; Carlstrom and Dorr Fields, Arcadia, Fla.; Americus, Ga.; Montgomery, Ala.; Camp Benning, Ga.; and Camp Bragg, Fayetteville, N. C. Traveling by train, it would have taken the Chief of Air Service several days longer to cover the activities which he inspected.

General Patrick, accompanied by Major H. A. Dargue, left Washington on May 19th, and proceeded by train to Miami, Fla., where they inspected Chapman Field. They were shown about Miami and Miami Beach by the President of the Chamber of Commerce of Miami. On Sunday, General Patrick, piloted by Major Dargue, made a 175-mile trip across the Everglades by way of Lake Ocochobie to Carlstrom Field in a JN-6 training plane. After inspecting Carlstrom and Dorr Fields they flew to Jacksonville, Fla., approximately 250 miles distant, in four hours flying time. They landed at Sanford, Fla., for gas and oil, and proceeded by way of Daytona and St. Augustine, flying about 150 feet above the beach and inspecting the beautiful scenery and resorts along the same. At Jacksonville they were met by two DH-4's which had been sent down from Montgomery, Ala.

On Wednesday, May 24th, General Patrick and Major Dargue flew to Americus, Ga., a distance of approximately 210 miles, in two hours flying time. After inspecting Americus, both the depot and the field, they flew over to Camp Benning, Ga., a distance of 50 miles, and attended the Barbecue incident to the graduation of the class from the Infantry School at that station. They left Camp Benning shortly after lunch and flew to Montgomery, Ala. This trip required 1 hour and 10 minutes, and they passed through several rain storms on the way. The next morning, the 25th, they left Montgomery at 7 o'clock and made a non-stop flight of 6 hours and 25 minutes to Camp Bragg, Fayetteville, N. C., the distance being 525 miles.

After inspecting the Air Service activities at Camp Bragg, they completed the trip to Washington in little less than 3 hours, a distance of 280 miles.

Training Schedule for 23rd Balloon Company

The 23rd Balloon Company, stationed at Post Field, Fort Sill, Oklahoma, started on a training schedule on May 1st, and the following military and technical subjects will be covered by July 1st: Field Service Regulations, Manual of Interior Guard Duty, Infantry Drill Regulations, Telephones, Windlass, Balloons, Machine Guns.

Activities of the 22nd Squadron (Observation)

An official report covering the operations of the 22nd Squadron (Observation) stationed at the Air Intermediate Depot at Montgomery, Alabama, during a period of six months from November 4, 1921 to May 4, 1922, shows that excellent progress has been made. Among the various achievements of this squadron during the above period, particular mention may be made of the fact that a total of 1364 flights were made for a total duration of 448.20 hours, with but one wreck, this being a plane returning from a cross country trip from Birmingham, Ala., which was forced down through inclement weather in a poor landing field. In landing the plane turned turtle, damaging the propeller, wing surface and rudder, no injuries resulting to either pilot or passenger. The plane was subsequently repaired and flown to its home station.

A summary of the work of this squadron is as follows:

	Flights	Hours
Cross Country	230	220.20
Target and Practice Flights..	781	117.15
Formation Flights	13	10.5
Infantry Contact	60	34.20
Communication Flights	80	22
Photographic and Reconnaissance	184	35.55
Bombing	16	8.25
Total aircraft flying time.....		448.20
Total number of man hours		837.35
Total number of man miles		40,904

During this period the squadron has successfully handled seventeen Infantry contact missions with the Infantry School at Camp Benning, Ga. These missions have required from one to seven planes. To successfully work with the Infantry School, it has been necessary, in a great many instances, to require the pilots and observers to remain overnight at Camp Benning. Twelve lectures have been given the Field Officers' Class, Company Commanders' Class, and Basic Class of the Infantry School at Camp Benning during the present course. Members of these classes who so desired were given a reconnaissance flight over the Camp Benning reservation. This was the first opportunity many of these officers ever had of taking advantage of an aerial flight. Fifty-five members of the Field Officers' Class, seventy-nine of the Company Commanders' Class and forty-six of the Basic Class were given reconnaissance flights, making a total of 180 students at Camp Benning, Ga., who took advantage of this opportunity.

During the last two weeks of February, two officers and ten enlisted men of the Communication Detail, 29th Infantry, Camp Benning, Ga., were ordered on temporary duty to the Montgomery Air Intermediate Depot, where they were given a course of training by the Radio Department of this Squadron in aerial communication. Numerous test flights and

special tests, as outlined by the Experimental Department of the Infantry School were conducted. This training proved of mutual benefit to the two arms, and the officers and enlisted men, completing the course, expressed themselves as being well pleased with the training received.

Eleven recruits were carried by airplane from Montgomery to their permanent assignments at Camp Benning. The flights accomplished were featured by the recruiting officers both of Montgomery and Camp Benning. Local articles were inserted in newspapers throughout the Corps Area as a means of stimulating recruiting for the Infantry School.

The strength of the squadron is 10 officers (8 pilots and 2 observers) and 90 enlisted men. The flying training shown above is in addition to the aerial observation training and military subjects covered during this period by both the commissioned and enlisted personnel in post and unit schools.

Bombing flights have but recently been started, due to the fact that no ground available at this depot for this training. Arrangements were recently made with the Infantry School, Camp Benning, Ga., whereby the squadron will use one of the many target ranges for this training. This will necessitate an hour's flight from the airdrome to the bombing range.

Conversion of a JN-6H Aeroplane into Ambulance Aeroplane

The Engineering Department at the Fairfield Air Intermediate Depot, Fairfield, Ohio, has completed the conversion of a JN-6H airplane into an Ambulance Airplane. In making this conversion no prints or data were available which were of any benefit in making up a set of prints by which the conversion could be made. Through the efforts of Mr. Herbert L. Penney, of the Drafting Department at the Depot, a drawing and set of prints were made of the proposed airplane and submitted to the Engineering Division at McCook Field, Dayton, Ohio and approved.

The take off is unusually long, due to the excess weight, but the ship handles well in the air, though not as sensitive as the controls as the standard type. The unusual feature of this type of Ambulance Airplane is the location of the physician and the litter. By means of a window, the physician can observe the patient at all times. The litter is easily accessible and can be removed from either side of the fuselage. A special compartment constructed in the fuselage takes care of the first aid kit, instruments or medicines.

The plane is equipped with a standard 31-gallon capacity tank, with an approximate flying radius of two hundred miles. It has a flying speed of from fifty to sixty-five miles per hour, and a landing speed of from thirty to forty-five miles per hour, depending upon the load. As altitude flight has been made, its maximum altitude cannot be given at this time.



FOREIGN NEWS



British Aviation

New regulations for securing greater safety on the Paris-London Air route have been accepted at a meeting of French and British pilots. They agreed to the outward and inward routes being separated by a distance of approximately 10 kilometers (6½ miles). This arrangement will add slightly to the mileage of the route from London to Paris and necessitates some change in the ground arrangements, including the provision of supplementary landing grounds for cases of emergency. The line from Paris to London will be via Beauvais, Calais, and Dover, while the return journey will be by Folkestone and Boulogne and then all to the right of the small hills at Cambres and Beauvais.

On Monday, May 7th, the first of the DH-34 machines belonging to the Instone Air Line made the inaugural flight from London to Brussels and back. The actual regular service is scheduled to start on May 15th, and the London-Brussels line may well prove in the future one of the most important radiating from London, linking up England with northern and central Europe.

One of the regular pastimes now for pilots flying between London and Paris on the British machines equipped with wireless is to ring one another up and have a chat in the air.

On Saturday, May 6th, further tests, this time successful, were carried out with the new parachute which is designed to lift a pilot out of a machine falling out of control. This time the tests were made with a pilot parachute, a very small one being first released, which pulls out slightly larger one which, in turn, exerts sufficient pull to release the large man-carrying parachute that finally lifts the pilot out of his seat. A ordinary parachute descent was also made.

Two Fokker monoplanes of the F3 type, but fitted with Rolls-Royce 20 h.p. engines instead of 240 h.p. Pumas, are to be put on the London-Amsterdam service. These machines while retaining the same passenger capacity (five) will have another compartment added for goods and baggage. They are intended to do the double trip in one day.

German Aviation

The Königsberg-Moscow air service on which Fokker monoplanes are used, was inaugurated on May 1st. At first the service will be bi-weekly, the machines leaving Königsberg at 9 a. m., arriving at Smolensk at 4:15 p. m., leaving Smolensk at 4:45 p. m., and arriving at Moscow at 10 p. m. In the opposite direction the times are as follows: Moscow 8:30 a. m., Smolensk 9:30, leave Smolensk 10, arrive Königsberg 3:15 p. m. Machines will leave Königsberg on Sundays and Thursdays and Moscow on Sundays and Wednesdays. The railway journey between Königsberg and Moscow occupies 12½ hours, and the flight between Königsberg and Moscow 9 hours, giving a total of 22 hours, as compared with more than five days by train. The air mail fees are to be marked for post cards and 8 marks for every 20 grammes in case of letters.

The prohibition of German aeronautical enterprise, enforced by the League of Nations during 1921, was scheduled to be lifted on May 5. Although the number of aeroplanes in use was negligible during the past year, German companies claim to have covered a total of 1,653,053 kilometers during the seven months from April to November, 1921, carrying 6,183 passengers and 30,713,428 kilos of post and parcels. Commercial Attaché C. E. Herring, Berlin.)

Traffic at Bourget

The traffic of the Bourget Aero Station (near Paris) is increasing considerably, according to La Journée Industrielle of April 9-10. In March, 1922, there were recorded 315 airplanes, carrying 846 passengers and 121,908 kilos of merchandise. The corresponding figures for March, 1921, were 250 aeroplanes with 681 passengers and 8,725 kilos of merchandise.

Belgian Service

The "Snet," a Government-subsidized aerial transportation company Belgium, has finished its trial period of passenger, merchandise, and aerial transport service between Brussels and cities in neighboring countries (Paris, London, Amsterdam, The Hague.) Belgian participation on these lines will, therefore, cease from June 1, 1922, leaving the services to Brussels-Amsterdam services in the hands of French and Dutch companies. A Brussels-London service will be organized by an English company, beginning in May of the present year. The Belgian Government studying the creation of a permanent organization which will permit that country to conserve an important position in international aerial transportation.

Dresden-Berlin-Hamburg

Beginning April 1, a daily passenger, mail and freight air service was established on the line Dresden-Berlin-Hamburg and return; also on the line Dresden-Leipzig-Magdeburg-Hanover-Bremen and return. The service from Bremen to Hamburg takes four and one-half hours, including a half-hour stop in Berlin. The journey to Bremen requires five hours, including 15 minute stops at Leipzig, Magdeburg, and Hanover. The fare from Dresden to Berlin is 500 marks and from Berlin to Hamburg 650 marks. This compares with 285 marks and 387 marks, respectively, for the first-class railway fare between the same points. The fare from Dresden to Leipzig is 500 marks and from Leipzig to Bremen 1,300 marks, as compared with 190 marks and 536 marks, respectively, for first-class railway fares between these points. Fifteen kilos of baggage is carried without charge, and all excess at the rate of 10 marks per kilo.—Commerce Reports.

Calthrop Parachute Tests at Croydon

Some interesting experiments were carried out at Croydon recently with "Guardian Angel" parachutes. Unfortunately time did not permit the carrying out of the full programme of the tests, but further tests are to be made later.

The first drop made was of a dummy man with the "H" type "Guardian

Angel" parachute with standard 28-ft. silk body. The dummy man was carried in the new frontal-suspension harness, fitted with instant connector and quick release, the life-line attaching the dummy man to this parachute being fitted with a small resistance parachute to show the advantage of providing additional resistance to speed up the disconnection of a "dropping" type parachute in a nose dive.

The test showed that the small resistance parachute, which was only 4 ft. in diameter, perceptibly speeded up the extraction of the parachute and pulled the dummy man considerably to the rear of the normal path usually taken.

In order to avoid any possibility of accident to a pilot or aeroplane, it is always preferable to test a new invention of this kind by a series of small advances without accident than to risk damage to the pilot and his machine by making too big advances at a time.

Although the resistance parachute opened instantly, Capt. Muir reported that no shock whatever was felt on his machine, so that on the next occasion it will be safe to employ a resistance parachute of much greater area, in which the effect would be much more marked.

In the second flight the dummy man was dropped with an "H" type parachute, fitted with a newly-invented "Calthrop" body, provided with three annular rings of air pockets, the object of which is to produce an enhanced cantilever effect of the compressed air passing under the periphery of the body, and thus giving additional resistance. Again, in order to proceed without them for the sake of safety to the pilot and the machine, the air pockets were contracted to about one-tenth of their full extension.

The opening of the body was extraordinarily quick, but perfectly elastic; and again Capt. Muir reported that there was no shock whatever to his machine. The result of the experiment was to show that the rate of descent was appreciably slower.

Aviators to Fly to Picnic

The first aerial picnic on record will take place in Paris, when thirty-five aeroplanes, bearing most of the famous pilots of France and the present and former Air Ministers and their wives, will take off from the Buc, Villa Coublay, Issy-les-Moulineaux and Toussus-le-Noble aerodromes for a landing field at Tillieres, sixty miles from Paris. Here a luncheon will be served from baskets brought on the planes.

Capt. Rene Fonck, with Under Secretary of Aviation Eynac as passenger; Adjutant Jean Casale, with Senator Flandin, former Aeronautic Secretary, and Mme. Flandin aboard, and Sub-Lieut. Charles Nungesser, carrying Count de la Vaulx, will form part of the group. Other aviators who will make the trip are Lieut. Bossoutrot and Sadi Lecointe.

The London Aerial Derby

The *New York Herald* correspondent states that the air will be "lashed into a frenzy" at Hendon when the aerial pageant takes place there June 24. Unheard-of stunts have been planned and the speed laws of aviation will be broken. The mystery planes belonging to the Air Ministry will take part and give the public the first opportunity to see these new planes designed to operate in conjunction with the battleship fleet. These amphibians are made for channel traffic as well, and as soon as an aerodrome on the Thames is erected they will also be seen there.

The most striking feature of the program will be massed aerial attack on an improvised desert stronghold. No detail has been spared to make the structure realistic. There are palm trees, loopholed minarets and lookout towers that rise to a height of 100 feet from within a high walled fortress equipped with guns. The defenders will wear Eastern costumes.

For fifteen minutes a battle will rage between an armed squadron of bombing planes and the defenders. Later Lieut. W. H. Longton will give an exhibition of "frenzied flying" and stunts near the ground.

Rumania Accuses Reds of Propaganda by Air

Formal protest has been sent to the Russian conference at The Hague by the Rumanian government, which declares Soviet Russia has violated the non-aggression pact by sending propaganda into Rumania by aeroplane. The government has made specific complaint relative to the recent capture of a Bolshevik machine and its crew near Tichina.

The New Russian-German Air Lines

On May 1st a most important development in air transportation was inaugurated by the opening of a direct and regular service between Königsberg in Eastern Germany and Moscow. During the coming months the line is to be extended to Berlin and the service will become a daily one in both directions. The importance of this development lies in the fact that the line is one of the very few, perhaps the only one, which is an undoubted economic necessity, all previously existing means of communication between Russia and Germany being in a state of chaos through the war and its aftermath.

At the present time it takes about 5 days, and a considerable amount of persistence, to travel between the two capitals. The mail takes an average of eight days and even telegrams four days in transmission. The section already in operation, Königsberg-Moscow, a distance of 780 miles, is flown during the day, in two stages of four hours each. The airline shortens the trip to 30 hours.

For the present, the entire passenger and mail space has been reserved by the German and Russian Governments for the use of couriers and the carriage of official correspondence and documents.

Although operated by a German company, backed by several of the greatest German industrial and shipping interests, the planes used are made in Holland and the motors are English. Ten Fokker F 3 monoplanes of the latest type were built at the Netherlands Aircraft Mfg. Co.'s plant at Veere, Holland, and successfully delivered by air. They are fitted with 340 h.p. Rolls Royce motors and develop a speed of 115 miles per hour. The cabin arrangements are even more complete than in the 3 machines which are so well known in this country. A large baggage compartment has been added behind the cabin, and for the use of the couriers 3 sleeping berths are provided, which can instantly be converted to seats for 6 persons for use in ordinary day time traffic. A very effective arrangement for heating the cabin with clean, warm air is also installed.



ELEMENTARY AERONAUTICS and MODEL NOTES



Details of Illinois Model Aero Club Models

(Continued from Last Week's Issue).

Bending Bamboo

A few simple rules will help an amateur to bend bamboo. First, use *good* bamboo; not old dry rotten stuff; scrape the hard outside off as well as the soft inside and hold it near the flame, either to one side or above, and move the piece back and forth until it commences to bend. A can be made much longer than B. and still not warp easily. If it does commence to warp it can be straightened easily. The cross-piece in A keeps the top-piece from sagging under the pull of the doped paper.

Adjustable Wing Clips for Scale Models

These clips make it easier to adjust the wings. Wire hooks C-C with two loops are fastened over the wing LD. Aluminum strips A-A bent double are fastened to wing struts B-B and then drilled twice as shown. Similar attachments to the rear complete the unit. With this arrangement the wing can be moved backward or forward and also be warped.

Double Surfaced Wings

Double surfaced wings are more efficient than single surface but are much harder to construct. A is the beam which, if pine, should be close to 1-32 inch thick. The height of the beam depends upon on the wing section chosen by the builder. E are the ribs, which are formed as close as possible to the section copied. Ribs should be made 1-64-inch sq. to 1-32-inch sq., according to the size of the wing, if the material is of bamboo. If the ribs are of balsam 1-16 inch, they should be about strong enough and can be hollowed out like the ribs of a large machine to make them lighter. Two bamboo pieces, B, fastened to the end of the wing-beam enable it to stand any shocks it receives in landing. If the brittle white pine were extended to the end of the wing it would very likely snap off the first time the tip received a severe shock. C, is the wing tip which should be bound as shown to the wing beam D, at the point F. Entering edge D is fastened to the ribs E as shown directly above the drawing of the wing tips. An expert with Ambroid can do this operation without binding. Entering edges 1-32 in. in diameter will stand the pull of a lightly doped wing with ribs about $2\frac{3}{4}$ inches apart. The paper can be stuck on the frame with either Le Page's glue or banana oil, and the surplus paper around the edges cut off with a sharp razor blade. Either one or two wing beams can be used in a double cover wing.

Scale Model Nose No. 2

This model nose is familiar to I. M. A. C. members. To the nose C is attached the block H, to hold the motor-base in place, by means of the wire spring E, which is looped under pins D, which are inserted in the nose. The dress snaps A are fastened to the balsa nose C by wire, thread, and glue. The other half of the dress snaps are lined up on the body in the proper place.

Scale Model Nose No. 1

Model Nose No. 1 is the same type that is used on the S. E. 5 scale model which was built by Mr. Jaros and flew so well. A is the balsa nose into which are inserted the wires E with snap style of end which does not pull out of the tube T easily. This can be made of aluminum sheet rolled if no other is suitable. To the nose A is also permanently fastened the two bamboo strips C, on each side of the hole for the motor-base. The motor-base is thus detachable. To the motor-base B is fastened the cross-piece D. The front of the nose is rounded to cut down resistance.

Wheels

Balsa wheels present a realistic appearance and are not so hard to make if one has an electric motor around the house. The rim is turned out of balsa by using sandpaper as a tool. Then the stiff paper sides C and D are glued in as shown.

Side D is one thickness of the stiff paper made into the form of a cone by cutting out a pie-shaped piece and gluing the edges together. The washer E is then glued securely to the center to be the bearing of the wheel. Another similar piece of paper is glued over the first to make two thicknesses for strength and this is followed by another washer. The hole at the center should be large enough to permit a large diameter pin to pass through and form the axle.

The paper wheel is easier to make. It is built up of two sides formed of the familiar cones which are glued together at the edges. Washers are glued inside at the center to form the bearing. They should be spun on an axle and trued before the glue sets.

The balsa and paper wheels are suitable for scale model. The small paper wheels are suitable for R. O. G. twin pushers but the small cork ones are better yet. A piece of balsa could be used in place of the cork piece B. Washer bearings are used as in the other wheels. D are the supports to which the axles are attached for use in twin-push R. O. G. machine.

The Preservation of Model Rubber

The rubber strands used for motive power on model aeroplanes is kept in good condition longer by keeping it well covered with soapstone when not in use. The rubber should be powdered after every five or six flights with graphite soapstone, or a mixture of both. Graphite is the best but dirty to handle. In making up the motors for a model it is necessary to make a joint in the rubber. The best way to do this is to tie a square knot in the rubber and roll it until it is securely tight. In keeping rubber, light should not be permitted to reach it and oil should be kept from it, for this will injure rubber.

The Illinois Model Aero Club

Mr. M. L. Bramberg, chairman of the Contest Committee of the Illinois Model Aero Club announces that his club is trying to get up a National contest for model aeroplanes during the Pageant of Progress to be held in Chicago from July 29 to August 14th.

It is their desire to offer cash prizes and trophies for different kinds of contests and to secure the co-operation of all other model aero clubs throughout the country.

Letters have been written to all the model clubs, but few have replied. Mr. Bramberg says the boys of the I. M. A. C. are beginning to believe they are the only ones in this country who can build record models and in order to find out if this is a fact or not, it will be necessary to establish a contest of this kind. The other model clubs should take up the challenge and a lively contest is sure to result.

The Illinois Model Aero Club has its headquarters at 4 South Michigan Avenue, a club room on the Parlor Floor of the Auditorium Hotel (care of the Aero Club of Illinois phone Harrison 3289) and the flying field is at Cicero Avenue and 83rd Street, Chicago, Ill.

World's Records of Model Aeroplanes

Tractors

Type of Contest	Record	Record Holder
Rise-off-ground, Duration.....	227.4 seconds	Breckenridge
Rise-off-ground, Distance.....	2685 feet	Breckenridge
Hand-launched, Duration.....	240 seconds	Lathrop
Hand-launched, Distance.....	2465 feet	Poole
Rise-off-water, Duration.....	116 seconds	Hitt

Twin Pushers

Rise-off-ground, Duration.....	170 seconds	Lauder (N.Y.C.)
Rise-off-ground, Distance.....	4029 feet	Schweitzer
Hand-launched, Duration.....	230.8 seconds	Schweitzer
Hand-launched, Distance.....	5337 feet	Hitt
Rise-off-water, Duration.....	118 seconds	Likovsky



RADIO DIGEST



Control Aeroplane Flight by Wireless in France

In addition to controlling the flight of an aeroplane by radio, attempts are being made in France to devise mechanism to enable a plane not only to ascend pilotless, but also to land without any hand on the controls.

Devices in course of perfection show wonderful ingenuity. In one case, a machine without a pilot, its engine having been started, runs across the aerodrome, causing to revolve at a rapidly increasing pace a small two-bladed fan or screw between the wings. The fan, as soon as it turns a certain number of revolutions, actuates mechanism which places the control surface of the machine in the right position for ascent, its maneuvers while aloft being controlled by wireless.

When the time comes for landing a signal has the effect of unrolling beneath the aeroplane a length of wire with a weight at the end. This weight, touching ground while the machine is at some little height, switches off the engine and causes the rear surfaces of the plane to set themselves in such a position that the landing wheels of the machine make a smooth contact with the ground.

French radio control of aeroplanes has achieved already a notable triumph. A large machine was taken up by its pilot, who left the controls and allowed the machine to be maneuvered for more than an hour by wireless operators in a land station far below. At a given signal the pilot resumed control and landed.

Radio Success Depends on Details

Attention to details which seem unimportant has made it possible for many a home-made radio set in the hands of a careful operator to establish a long-distance record of clearness of signals far superior to the attainments of an elaborate outlay of instruments under the operation of a careless operator. In radio receiving a feeble electrical current is being dealt with, and the little things which seem almost insignificant amount to a great extent in successfully developing a weak signal to audibility and a loud signal to marked intensity.

A straight copper wire, size No. 14, about 100 feet long, serves as an excellent antenna for receiving radio broadcast news and music. The outside antenna is subjected to the elements of the weather, and is also in a position to swing about in the wind. All aerial connections should be soldered firmly, thus affording good electrical connections and keeping joints free of dirt, which is likely to serve as insulation. Antenna connections are not soldered the result is certain to be loose connections when the wind blows. The antenna should be well insulated and free from all objects. Otherwise, especially in damp weather, leakage of the energy, if not all, will find its way to the ground before reaching the receiving instruments. The antenna wire must be either bare or covered with insulation. It is important to connect the ends of the wire to insulators instead of direct to the spreaders or poles, because wood when wet is a good conductor of electricity. The guy wires also should be taken up by an insulator. Never erect an antenna parallel to telephone or electric light wires, as interference by induction

generally results. In many instances where radio wires have paralleled a telephone line the regular phone conversation has been heard in the wireless receivers.

The ground connection should be soldered or clamped securely, instead of carelessly wound around a pipe or rod which leads to the earth. Before the connection is made the pipe or surface to be connected should be thoroughly scraped and cleaned. A faulty ground connection has hindered many a fine radio set from producing clear signals. A copper boiler or sheet buried several feet in the earth serves as an ideal radio ground because it has considerable area. Surround the copper surface with charcoal and sand, as such a combination tends to hold moisture around the metal, making it a more efficient ground.

The next best ground and easily within the reach of all is the cold water pipe. The next selection is the radiator, and then the gas pipe. Architects, when planning a home, may soon provide for a radio ground connection. A sheet of copper could be buried underneath the cellar floor and the connection extended to the baseboard sockets in the music room, living room or any room in the house where a radio set might be used.

All connections in a radio hook-up should be soldered whenever possible. By constant turning of the knobs and dials the wire in time will work loose and trouble result. Sliding contacts and switch points always should be kept clean, as dust and grease are sure to accumulate and serve to insulate the electrical connection. It will be surprising how neatness, cleanliness and attention to details in radio work make possible increased range and intensity.

Efficiency of Indoor Aerials

The greatest mystery of radio, in the minds of many people, is that the signals can be intercepted by an aerial inside a building without even a window being open. The results with an indoor antenna are not as satisfactory as when the antenna is in the open. Nevertheless, with a step or two of amplification remarkably clear, signals may be heard by the use of an indoor antenna. A wire extended down the hallway and hidden behind the molding will give astonishing results.

Little do we realize as we sit in our homes reading the papers that the latest news of the world is passed before us—in fact, right through our bodies—at the speed of 186,000 miles a second. Every minute of the day and night invisible radio waves rush through our homes and offices, carrying the melodious strains of bands and orchestras; the voice of a speaker far away, or the dot and dash of a ship in mid-ocean. The messages of the world are ever present just like the medium which transports them—the ether.

Ether is an invisible, odorless, tasteless substance found everywhere from the most perfect vacuum to the highest and greatest mountains. Therefore, anything traveling with such a substance as its medium of transportation goes through everything and thus radio travels unseen, showing no preference, through the millions of homes in the world. A little receiving set connected to a wire inside the house will prove that there is more truth than poetry in the lines of the old song, "There's Music in the Air."

Radio Wave Lengths

The distance a radio wave travels does not depend upon the length of the wave, as many people think. The power of the transmitter and the sensitiveness of the receiving apparatus govern to a great degree the distance the signals may be heard, and atmospheric conditions also play a part. A short wave may travel thousands of miles, but it is not capable of carrying high power and, therefore, the message carried on a low wave length weakens as it gets further from its origin.

A wave length is the distance from one point in a wave to the next point in a like phase; in other words, the distance from crest to crest. Long wave lengths are used for long distance work because low frequency currents carry far better than high frequency currents, which make up the shorter waves. Wave lengths are measured in meters, a meter being 39.37 inches. When the instruments are tuned to receive a certain wave length they merely pick up sounds of a definite number of vibrations. Enemy submarines during the war used as low as 75 meters for transmission, and the powerful station at Nauen, Germany, used a wave of 12,600 meters.

The Lafayette station near Bordeaux, France, uses the longest wave of any radio station in the world at the present time. It is 23,000 meters, about fourteen miles in length. Second place belongs to Long Island Central—19,000 meters. This is approximately twelve miles from crest to crest for a wave leaving the Long Island station. The distance a message travels from Long Island to Germany is about 4,000 miles. Thus, there are a trifle more than 333 complete dips or troughs in the distance between Long Island Central's antenna and Germany's wires. Arlington, Va., sends time signals on a 2,500-meter wave. Radio telephone broadcasting from WJZ, Newark, and the majority of other broadcasting stations, is on 360 meters.

Care of the Storage Battery

A storage battery might be termed the heart of a radio receiving circuit when the vacuum tube is used in place of the crystal detector, as it renders the life-giving current to the hook-up, which is merely the veins and arteries of the receiving set.

The storage battery—or, as it is called in radio, the "A" battery—must receive a certain amount of care and attention if it is to produce efficiently over a reasonable period of years. The development of radio equipment during the last year or two has made it possible for operators of audion sets to charge their own batteries, and it must be remembered that violent discharging and excess overcharging shortens the life of the cells, causing injury to the plates by warping or buckling.

Distilled water should be added to a battery at least every two weeks. The electrolyte, which is a definite mixture of chemically pure sulphuric acid and pure water, should not be permitted to fall below the tops of the plates. Exposure of the plate tops induces sulphation, a chalky deposit, which is a non-conductor of electricity, thus causing internal resistance. During the summer months it is well to add water once a week, as evaporation is more rapid in warm weather. Care must be taken not to raise the electrolyte level too high above the plates, as the solution is apt to slop over

and cause a short circuit on the exterior of the battery. The electrolyte also will eat the case and sulphate the terminals. This may be prevented by wiping off the terminals with a vaseline-covered rag. It is a good rule to keep the electrolyte level about one-quarter of an inch above the top of the plates, and always keep the top of the battery case dry and clean.

Idleness is bad for batteries, so if the reader goes away during the summer months the radio storage battery should be left in the care of a battery service station and charged at least once a month during periods of idleness.

It is always well to have a syringe-hydrometer as part of a radio equipment. Such an instrument indicates the condition of the storage cells. The power of a storage battery gradually diminishes as it is used, but after a certain point of discharge is reached it weakens quickly, without any advance notice, and in such a condition is of little service to the audion. Therefore, it is well to test the specific gravity of the cells from time to time. A musical concert may hold special interest some night, and it is aggravating to have a battery weaken on an occasion when its best performance is needed.

To test the specific gravity of a cell, remove the vent, insert the tube at the bottom of the hydrometer syringe into the electrolyte. Squeeze the rubber bulb, then remove the pressure from the bulb. Electrolyte will rise in the glass barrel. Read the figure reached by the surface of the electrolyte. The figure 1.285 is the "full charge" for battery specific gravity. The figure 1.270 indicates one-quarter discharged. The reading 1.255 shows that the battery is half discharged. At 1.225 the battery should be charged.

After the reading is noted, squeeze the bulb to expel the liquid from the tube and always restore the electrolyte to the cell from which it was taken—never to another. Always take the hydrometer reading either before adding water or after there has been an hour or two of use to insure thorough mixing. Water mixes slowly with the electrolyte since the acid is the heavier.

The Buzzer Test

In using a crystal receiving set the first operation is to adjust the detector; that is, find a sensitive spot on the mineral, generally a piece of galena. All crystals have good and bad spots and therefore a fine wire which makes contact with the surface of the galena must be moved about until a sensitive spot is located. After the select spot is discovered the detector is all set to perform by permitting the passage of the feeble high-frequency wireless currents through the phones and causing the diaphragm to vibrate, producing a sound audible to the ear of the operator.

When an operator opens the crystal set for "listening in" he must adjust his crystal by the music or signals passing through the air, and by doing this a part of the concert is lost. A buzzer test serves to have the apparatus adjusted to its maximum degree of sensibility when the broadcasting concert begins. An operator might sit for hours "listening in" with the idea that the crystal detector was finely adjusted and still have the contact wire off the sensitive spots. When a buzzer test is used the operator can press the button or close the switch which completes the buzzer circuit at any time and thus be assured that the set is perfectly adjusted. The buzzer merely sets up vibrations in the receiving set which are used as a substitute for radio signals.

Getting Results from Home Radio

Radio receiving has passed the experimental stage and reached the point where

it is a source of amusement, pleasure and instruction to the average person. As a matter of fact, the majority still regard radio as a means of receiving, rather than transmitting.

Roughly speaking, there are three types of receiving sets today, each with many modifications and varieties. The best known and least expensive is termed the Crystal Set. Many amateurs have constructed their own sets of this type, or they can be purchased complete. The radius of operation and efficiency is limited, ordinarily, to within twenty-five to fifty miles of the broadcasting stations, and requires the use of head-sets, without permitting the use of a loud speaker.

The next set is called the Audion or Vacuum Tube, with a range up to 500 miles if only one detector and one amplifier be used. By increasing the number of tubes the radius can be extended to a thousand miles or more.

The third type embraces the vacuum tube, the cabinet also containing a regulation phonograph equipment, whereby the one instrument, at the will of the owner, can be used for the receiving of wireless messages or the playing of phonograph records.

Knowledge

"Listening in" is far more enjoyable and much better results can be attained when the sets are understood in greater detail, and how and why the various instruments are used, rather than by "just turning a knob or a dial."

Function

The function of a receiving set is to absorb the energy from the passing electromagnetic waves sent out by the broadcasting stations in the form of what is technically termed radio frequency oscillations, and then to transform this energy into audible sounds, be it music, speeches, or what not; in other words, to make it possible to hear clearly and distinctly.

Construction

The principal parts of a receiving set include the antenna, or aerial, which is a copper wire that intercepts or catches sound waves. Satisfactory results require at least one hundred feet of wire. With the improvements in amplification, it is now possible to use indoor aerials with splendid results. It is said that a well-grounded aerial will protect a whole city block from being struck by lightning.

The antenna transfer switch, which serves to connect the aerial with the set itself, is another important unit, and telephone receivers, commonly called head-sets, are essential. Radio phones are said to be of high frequency because of the great length of fine wire used in their coils, but, as this wire is always the finest copper, the resistance of a good phone may be as low as 2,000 or 1,500 ohms. The ohm is the unit of resistance. As a matter of comparison, the average telephone receiver is less than 100 ohms. The cross-sectional area of the radio phone is low; therefore, higher resistance is not wanted, but cannot be avoided. A few turns of German silver wire would produce 2,000 ohms resistance, but no magnetizing effect.

Radio phones have permanent magnets to keep the diaphragm under a constant strain, to prevent hysteresis (heat) losses. They will not operate on oscillating current, because the inductive reactance is too great and the current cannot pass through the phone. Even if the current could pass, the diaphragm could not vibrate so fast, and if the diaphragm could vibrate at that speed the human ear would be unable to hear it.

The loading coil, which makes it possible to increase the wave length of the set, thereby enabling the user to hear a greater number of stations.

The receiving transformer is designed to transfer the weak oscillations of extreme high frequency from one circuit to another. In the words of the layman, this merely means a finer tuning, eliminating interference of other stations.

The detector apparently is the most important part of the set to the average person. It rectifies the incoming oscillations of the wave train into direct pulsating currents, thus enabling operation of the phone at audible frequency.

The broadcasting stations transmit sound waves, termed radio frequency, at a rate as high as 100,000 oscillations a second, but the human ear cannot hear in excess of about 1,000 a second. Therefore, the detector actually transfers the waves from radio frequency into audible frequency.

When the condenser, which controls wave lengths, is put in series with the ground tends to shorten the wave length. Placed in parallel to the open circuit, it permits the reception of longer waves. Placed parallel to the closed circuit, it is used to bring the secondary into resonance with the primary. Placed across the phone, it stores up the rectified oscillations and then discharges them through the phone with cumulative effect.

The buzzer circuit, which enables the operator to adjust his detector in advance to the maximum degree of sensibility, gives assurance that a calling station can be heard.

The safety or micrometer gap is connected across the aerial and ground terminal to prevent static discharges or strong near-by signals from throwing the detector out of operation.

The amateur, to increase his knowledge and obtain the best results, should study radio in the following order: Construction, arrangement, operation, function, care and principle of operation.

Detector

The crystal detector is mentioned so often that it is worthy of description. Galena is the most used mineral and is the best for the reception of weak signals. It is the most suitable for the set of short range. Carborundum as a detector is very stable and not affected by strong currents, but fails to be a good rectifier. Silicon is not as sensitive as galena, but is a better rectifier than carborundum. A sharp point of antimony pressing on silicon gives good results, but is not as sensitive as galena and will not give as loud and clear signals.

Audions

The simple audion or vacuum tube circuit consists of five parts—the bulb, containing three elements; the filament, grid or zig-zag wire, and the plate, which is solid metal; high voltage or B battery; low voltage or A battery; rheostat in control of the A battery voltage; condensers in series with the grid.

The primary advantages of the audion compared with the crystal is that it is more sensitive, is not so readily put out of adjustment, permits receiving from broadcasting stations at a much greater distance, and enables the use of a loud speaking horn, whereby sounds carry clearly in large room and in auditoriums.

Coupling

Coupling is the method of transferring the energy absorbed by the aerial from the primary to secondary. It permits a finer tuning, thus preventing interference when two or more stations are broadcasting simultaneously on a similar wave length.

Close coupling results in a larger transfer of energy from the primary to the secondary, and the circuits need not be in resonance. It is used for "listening in," many wave lengths can be heard without readjustment.

Loose coupling gives a smaller transfer of energy from the primary to the secondary circuits. With this type the circuits must be in exact resonance. It is used in tuning out or preventing interference, as only one station and one definite wave length can be heard well.

The primary circuit is used for the original or crude tuning, which is transferred by mutual induction to the secondary circuit, which in turn gives the finer tuning.

When the broadcasting station and the receiving set have the same wave length they are said to be in tune or in resonance. Where the wave length is different, naturally there must be an adjustment on the part of the receiving set.

The characteristics which determine the efficiency of the receiving set are: Range—detector and phone; audibility—condenser; selectivity—coupling.

To tune a receiving set to a distant broadcasting station it is necessary to adjust detector to its maximum degree of sensibility by means of the buzzer circuit. At the secondary to approximately the desired wave length, using large values of inductance and small values of capacity. Increase or loosen the coupling. Add or subtract inductance and capacity in the primary circuit until response is heard in the phone. Loosen the coupling until interference is eliminated or reduced to a minimum. Try new values in both circuits until the loudest sounds are heard with a minimum of static and interference.

If the secondary circuit is calibrated, it can be set at once to the desired wave length. The primary is not calibrated, due to the fact that no two aërials have the same wave length. After installing a set of a certain aerial, the operator can make proper calibrations on the primary.

Field Locator Makes Travel by Air Safe

Radio and flying are inseparable. This fact is becoming more and more evident to those engaged in the development of commercial aviation. Radio has already moved the terrors of fog from aerial navigation and has made night flying possible. Without night flying no system of aerial transport will ever be successful. In a recent article on this page the work of the United States Air Mail Service was outlined. This service has done some remarkable pioneer work in the development of radio as an adjunct to aerial navigation, and of this work there is no question that the field localizer is the most important of

It is one thing to guide an aeroplane safely through a fog to the place where the pilot of the machine desires to go and quite another to bring the ship safely to earth. This fact was demonstrated in the transatlantic air race two years ago, when a big Martin bomber was caught in a fog between Des Moines and Omaha. Her pilot used all his skill and judgment in bringing the big machine to earth, but was unable to avert a crash. His skill reduced the seriousness of the forced landing, but did not prevent the subsequent crash.

Fog Chief Danger in Flying

There is no more embarrassing situation for the pilot of an aeroplane than to be in a dense fog at the end of his journey without fuel. It is impossible to remain in the air and yet he does not know the nature of the ground below him. A crash under these circumstances is practically inevitable. With this situation in mind, the engineers of the United States Air Mail Service started three years ago a series of experiments designed to eliminate this danger in the art of aerial navigation, and they naturally turned to radio as the means to relieve their object.

With the experience of the radio direction finder before them, they know that electro-magnetic waves could be sent out in one direction with certain types of transmitting equipment. Now, the logical inference was that if apparatus could be developed which would shoot a beam of electro-magnetic waves vertically into space, a pilot would be enabled to tell just when he was over the center of the landing field where he desired to alight. This is the basis of the radio field localizer, which was subsequently successfully developed.

System Not Perfected

The perfection of this apparatus did not, of course, come immediately. It followed a series of careful and persistent experiments, which at first were far from successful. The system, however, has now been perfected, and will soon be in general operation at all of the air mail flying fields, in accordance with the radio expansion program which the chiefs of the service are now engaged in promoting.

The official description of the apparatus is as follows: "The localizer is a device for transmitting radio signals more or less vertically, so as to form an electro-magnetic field over the landing field itself, and extending to a sufficient altitude to enable the pilot to intercept this zone of sound above the clouds or fog."

When the experiments were first started, efforts to achieve the end in view were made with a current of audio-frequency. Coming back to the official description, we are told: "This device consisted of a single turn of wire of fairly large diameter, with weather-proof insulation, which was laid around the outside of the flying field."

Audio-Frequency Used with Loop

"In actual experiment this turn—or loop—was 2,500 feet in diameter. It was found that when the output of a 500-cycle generator was supplied to this loop directly with key modulation, an electro-magnetic field was produced in the form of a cone whose area decreased with altitude. The uppermost effective limits of this device were around 3,000 feet."

For practical purposes this system was not successful, as a study of the results obtained will show. As described above, the electro-magnetic field above the loop aerial was in the form of a cone with the apex in the clouds. Now it will be readily seen that an aeroplane flying at normal altitudes would have extreme difficulty in passing through the zone of the electro-magnetic field, and it would be only the merest chance that he would happen to strike it. Machines flying at greater altitudes than 3,000 feet would not pass through the magnetic field at all.

There was another disadvantage to this system, and it lay in the fact that as the cone of the magnetic field was pointing upward, the width of the field was greatest at its base, which, of course, was on the ground. This meant that as the pilot came closer and closer to the ground the more uncertain he would be as to just where the center of the landing field was located.

An Inverted Cone Needed

From this it will be seen that what was needed was an electro-magnetic field in the shape of a cone; whose base was up in the clouds and its apex on the ground.

The next experiments designed to achieve this result were made with currents of radio-frequency. The device used to accomplish this result has been standardized and is the so-called "field localizer." Reverting back to the official description, we find the following:

"This device consists of two loops, each with a single turn, separated by a distance of about twelve feet, wound parallel to the earth's surface. A radio-frequency current

is used, which flows through these coils in opposite directions.

"In actual practice these coils are wound around a wooden hangar, from which they are carefully insulated. As stated, a radio-frequency current is used in this device with key modulation. The resulting electro-magnetic field takes the form of a cone whose size increases with altitude, so that at a height of 3,000 or 4,000 feet the diameter of the cone is over half a mile."

It will be seen at once that this is the ideal situation, because the greatest area of the electro-magnetic field is where it is most needed—that is, at high altitudes.

Pilot Can Lay Straight Course

Now, the pilot caught in a fog can determine his exact location by means of his wireless compass, or radio direction finder, and he will then know how far away he is from his home field and what direction the field is bearing away from him. He can then lay a straight course for the field.

He then has to pass into the zone of the electro-magnetic field of the localizer, and with known current strengths he can pretty well estimate his altitude above the field, especially with the aid of his altimeter. The wonderful part of the inverted cone electro-magnetic field of the localizer is that it enables the pilot to spiral down slowly and gently along its outer edges until he can discern the outline of the landing field below him.

It has been found in the experimental and practical work with this device that the ordinary direction-finding apparatus installed on the aeroplane can be used successfully with the localizer. This is a very important thing, because it reduces the amount of apparatus necessary on the aeroplane and correspondingly keeps the duties of the pilot within reasonable limits.

The experiments with the audio-frequency currents which were first carried out made it necessary to install separate coils around the outer edges of the lower wings. This was unnecessary with the radio-frequency currents.

The field localizer and the radio direction-finder have eliminated the last preventable causes of danger to aerial navigation, and what is more important, they make night flying an actuality.

In connection with the immediate plans of the Air Mail Service, Colonel Paul Henderson, Second Assistant Postmaster-General, makes the following statement:

"We have come to the conclusion that the air mail has reached its limit operating only by day, because the railways afford a twenty-four-hour-a-day service. For several months we have been arranging for night flying. Two big tasks were to be done; one, equipping of all mail planes with radio; and second, establishment of aerial light-houses or electric beacons and flood lights at emergency and regular mail fields, at approximate distances of thirty to forty miles, all the way across the continent between New York and San Francisco. We are doing these things at present.

"Our fourteen main fields are equipped with radio stations, and we hope to have the first of the planes equipped with radio shortly. They will have wireless telephones and radio direction-finders. By using the direction-finder a pilot will be able to keep on his route in darkness, storm or fog, and the beacons at his objective will guide him directly over the field when the floodlights will be turned on, enabling him to land as easily as in daylight.

"We have already carried the mail from coast to coast in less than thirty hours, and we think we can provide steady service of this sort. It will be important, too. For example, mail leaving New York after the close of business will be delivered in Chicago before business starts next morning.

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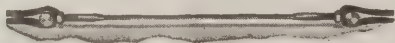
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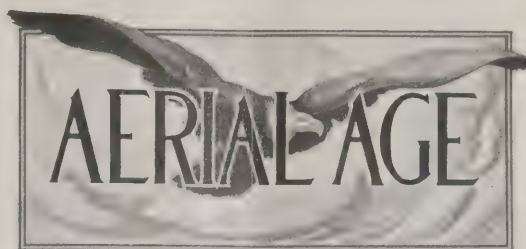
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Commercial and Military Aeronautics

By WILLIAM KNIGHT, M. E.

SEVERAL criticisms have been made from time to time on the matter of the more or less perfect adaptation of the military flying machine which was practically born and developed during the war to the needs of post-bellum commercial aviation.

"The Commercial aeroplane does not exist in America" was the surprising statement attributed to one of our best flyers a few weeks ago after unsuccessfully attempting a cross-country flight on a good machine which has successfully stood the more severe tests both in Germany where it was born and in this country where it has been adopted by Larsen.

It is out of question that the commercial aeroplane of to-day is far from being the ideal means of transportation in the air, but this is not a good reason for condemning the present day commercial aircraft and for casting a shadow of doubt on its present and future possibilities.

So far as commercial aviation expenditures, even in France where the Government has taken an active interest in its development that has not been equalled by any other government, have stood a very poor comparison with military aviation expenditures. Two hundred and forty-six millions of francs for military aviation and forty-five millions for commercial aviation are such figures that explain quite eloquently why the military flying machine has progressed since the war at such a rate which cannot be compared to the progress made by commercial aircrafts.

To this country, the comparison is even more discouraging because the only money that we are opening at the present time for commercial aviation is the money which is being spent for keeping alive what remains of our mail service.

The development of a truly commercial aircraft, quite evidently requires money. Aircraft manufacturers in this country are not generally inclined to invest large sums of money in experimental machines radically new, without any subsidy being aid by the government for that purpose.

Aircraft manufacturers in Europe are doing their best to develop new commercial types of aircraft in spite of the fact that they find themselves seriously handicapped by some features that they have to include in their designs in order to be able to collect from their governments those subsidies that they cannot afford to dispense with at the present time.

On the other hand, however, if the aerial operating companies in Europe had waited for the perfect commercial aircraft to make its appearance before starting operation, nobody at the present time would be flying from Paris to Casablanca and to Warsaw in twenty-four hours and from Paris to Constantinople in two and a half days.

If marine, automotive and railroad engineers had sought the perfection before attempting operating engines that they knew quite well had to be further developed and perfected, we would have never had the steamship, the automobile and the railroad train, because the only way how to perfect a mechanism is to use it first as it is and see after what is needed to improve upon it.

In 1911 after the raid made by Paulhan d'Orleans at Arcis-sur-Aube somebody suggested to a well known high rank French officer who was in charge of aeronautical developments at the Ministry of War, that the time had come for organizing some military air squadrons, the answer was: "Wait, wait, do not run so fast with your imagination; the aeroplane is far as yet from being in such a shape as to warrant its use in the army." And this happened only three years before the war started.

If we had waited for development of ballistics before building and using guns we would probably have now the same armament which was used by the Indians.

Thirty-five years were needed before reaching the present stage of development of the steam locomotive, twenty years were required to perfect the marine engine and fifteen years have been spent in perfecting the automobile. Do the critics of present day commercial aviation propose to wait twenty years before considering the aeroplane as a safe and efficient means of transportation?

Such critics are ready to concede that the aeroplane is an efficient war engine, but cannot separate in their mind the military from the commercial aircraft. This is an error. The divorce of commercial aviation from military aviation is absolute, and it has been recently sanctioned in the note sent by the allies to Germany concerning the resumption of German commercial aeronautical activities which, it has been decreed by the allies, must be based on the following conditions to be fulfilled by the German aircraft manufacturers: Ceiling 4,000 meters; speed at 2,000 meters altitude, 170 kilometers per hour; fuel

for 3 hours flight; useful load 600 kg.

These conditions very nearly represent the average present state of affairs in commercial aviation and mark the beginning of the application of a sound economical regime for commercial aircraft.

Military aviation, on the other hand is progressing along an entirely different road: a pursuit aeroplane must be able to climb rapidly to 25,000 or 33,000 feet altitude and fly horizontally at 170 miles per hour; a bombing aeroplane must also be able to climb up to high altitudes with several tons of bombs on board and must be able to cover without stopping 500 miles or more.

At first sight the bombing aeroplane seems to be the best type which can be adapted to commercial exploitation. It is very often stated that the price of the ton-mile decreases with the increase of the load carried. These conclusions are arrived at through the mistake which is often made of comparing the aeroplane to a ship. A ship floats on the water without any need of motive power, while instead an aeroplane needs motive power in order to sustain itself in the air. Also the ratio between useful load and total load of a ship, for the same speed, increases with the dimensions of the ship whereby in an aeroplane this ratio remains practically constant.

An average attained by figuring on the characteristics of all sorts of aeroplanes, except scouting aeroplanes, shows that the load lifted by the present day flying machines is from 14 to 16 lbs. per h.p. or from 9 to 11 lbs. per square foot of lifting surface irrespective of the dimensions.

These are the fundamental basis which determine the separation of military and commercial aviation and it is an error to assume the interdependence existing between these two well defined and entirely separate phases of aerial navigation.

To talk about building commercial aircraft which in case of a national emergency can be efficiently adapted to military uses is a very optimistic talk. Of the 598 commercial aeroplanes now in use in France only a very small percentage could be used for military purposes and this fact is well recognized by French and other aeronautical experts.

We think that these facts should be stated and that it should be dispelled the delusion under which we are inclined to live that by developing commercial aeroplanes which repre-

sent a compromise between commercial and military exploitation we are helping to build a powerful aerial defense at the same time that we provide for a fleet of efficient aerial commercial carriers.

The problems of military and commercial aeronautics are entirely separate the ones from the others and to put commercial aeronautics in this country under the control of military aeronautics as is the case in France, for instance, would be a mistake. What we need is a department of aeronautics, separate from both the

Navy and the War Departments which will consider the problems of civil aviation from an entirely civilian standpoint.

But above everything else what we need now is to stop talking about commercial aviation and the limitation of present day commercial aeroplanes and start operating commercial lines with whatever commercial flying equipment we have at the present time. This is the only way that we can ever hope to develop aeroplanes well adapted to commercial uses.

Aircraft manufacturers who at the

present time are living on government jobs will give to us the commercial aeroplanes that we need if we can show them that there is a field for such a production. We cannot expect aircraft manufacturers to design and build for us such aeroplanes without any subsidy on the part of the Government and without any organized commercial activities in this country.

Let us get busy, let us start doing something constructive for establishing civil aviation in the United States on sound business basis.

Remarkable Performance of the Loening Air Yacht

THE Loening Aeronautical Engineering Corporation delivered the air yacht ordered by Mr. Vincent Astor on schedule time, with no delays whatsoever, and the machine was flight tested by David H. McCulloch at Port Washington on June 19th and 20th, so that Mr. Astor, on his return from Europe on June 23rd, found his machine entirely ready for him.

He arrived on the *Mauretania* about eleven o'clock in the morning and after spending some time in the city, motored to Port Washington, and flew on his air yacht in about 50 minutes to New London, arriving there in ample time to see the Yale-Harvard boat races.

No other means of travel could have accomplished this result.

Several of Mr. Astor's guests took flights in the new machine after its arrival—a party of them returning to New York quite late the same night, arriving after dark.

Clifford Webster is pilot of the *Astor Air Yacht* and on June 26th flew up to Poughkeepsie with Mr. Astor and a party to attend the intercollegiate boat races there. The trip from New York to Poughkeepsie was made in about 50 minutes, and the return trip in about 40 minutes—most of the trips being made at a cruising speed in the neighborhood of 110 miles an hour.

The *Astor Air Yacht* differs only in detail from the original model of the *Loening Air Yacht*. The seating arrangement has been modified and a complete dual control system installed as Mr. Astor will fly the machine himself from time to time. The door to the cabin, formerly on the side, has been placed in the bow, and many detail arrangements, such as the anchor and other equipment, have been greatly improved upon.

Special lockers for goggles, helmets, etc., have been provided.

Structurally the new flying boats

are virtually the same, with the exception that the wings themselves have been increased in area, and in the interior of which all metal fittings have been doubled in thickness in order to give ample margin for the possibility of rusting.

The bottom of the hulls are made of an aluminum alloy, treated inside and out with a special marine glue preparation to prevent deterioration from salt water.

The new machines also have a larger gasoline capacity—Mr. Astor's air yacht carrying enough fuel to fly it non-stop for 500 miles.

The finish of the *Astor* machine is, of course, specially chosen by the owner. The color is a light grey, with dark grey finishing lines. The wings are treated with pigmented aluminum colored dope and the interior of the cabin is fitted with blue leather upholstery and light varnish woodwork finish.

The owner's private signal—a red star on a white field—flies at the mast, which also serves to hold the speed indicator tubes.

The instrument equipment is complete with compass, drift indicator, gas and oil pressure gauges, thermometers, tachometer, altimeter, air speed meter, etc.

The actual delivery of Mr. Astor's *Air Yacht* was of considerable interest, because the *Loening* plant, where this machine was constructed, is equipped with special Ogden type doors which, when raised up, form a clear opening 46 feet wide and 18 feet high. This is the largest opening in any building on Manhattan Island. It was thus possible, after the final assembly of Mr. Astor's machine in the factory, to wheel it out of the doors and on to the dock, where it was hoisted aboard a lighter and brought to Port Washington completely set up and ready for its initial flight tests. This is the first time that a fully set up aeroplane

ready for flight has been brought out of a building in New York City.

There has been a great deal of flying lately on the *Loening Air Yacht* in this vicinity.

One of the most interesting experiences in this connection was had recently by Mr. Harold S. Vanderbilt, Commodore of the New York Yacht Club.

Mr. Vanderbilt has been flying with Mr. David H. McCulloch on the *Loening Air Yacht* ever since its return from Palm Beach and has made many trips, some as far as Marblehead, Mass. The following schedule all done in one day, shows the remarkable ability of machines of this kind to cover long distances.

On Monday, June 26th, Mr. Vanderbilt played 18 holes of golf at the National Golf Links at Southampton, Long Island. He left there, accompanied by three friends, at about 12:30, with Harry Rogers piloting the *Loening Air Yacht*, and landed at 82nd street and the Hudson river in 52 minutes. This is a distance of approximately 95 miles, so that the average cruising speed was about 120 miles an hour.

The party lunched at the Columbia Yacht Club and then went to the Polo Grounds to attend the Yale-Harvard baseball game, leaving the *Air Yacht* anchored in the river. They stayed until the end of the game and then returned to the Columbia Yacht Club, where they again boarded the plane and proceeded to fly to Poughkeepsie to attend the 'varsity boat races, arriving there in time to see the entire race.

The party left Poughkeepsie about 7:15 and arrived at Port Washington, Long Island, about 45 minutes later in time for dinner on Long Island.

Mr. Vanderbilt has ordered a *Loening Air Yacht* for his own use and this machine will be delivered to him about the middle of July and will be piloted by Harry Rogers.

A Challenge to the World

A CABLE dispatch to the Air Ministries of Great Britain, France, Italy, Spain, Portugal, Belgium, Norway, Sweden, Denmark, Cuba, Mexico, Brazil, Argentine Republic, Chile, Peru, Japan and China, over the signature of Rear Admiral Bradley A. Fiske, U. S. N. retired, challenged the aeronautical engineers and sportsmen of those powers to enter into a competition with a similar American group to circumnavigate the world with a commercial hydro-aeroplane of one hundred passenger capacity.

This action disclosed the fact that a large group of American engineers have reached the conclusion that the era of commercial navigation on a big scale is at hand and that they have carried experimentation to a point where the design of the American entry for such a competition has been tacitly accepted. Details for financing and building the enormous flyer have been worked out and the group is prepared to put their scientific conclusions to a practical test by precipitating the international contest.

The challenge to Great Britain, of which those to the other countries are practically duplicate, follows:

"Please convey to representative group of British aeronautical engineers and sportsmen the compliments of American group affiliated in the project to build hydroaeroplane of hundred passenger capacity to circumnavigate the world for advancement of commercial aerial navigation. Stop. Also please convey friendly challenge to compete with British ship. Stop. Conditions of contest and details by mail upon receipt of assurances of entry.

The challenge followed the organization of the group as a trust estate under the name of "The American Eagle"—which has been adopted for the name of the airship when completed. Among the prominent engineers, aeronautical experts and scientists included in the group the following were mentioned yesterday by Secretary Cyril O. Assmus, in announcing the issuance of the challenges: Charles W. Burrows, Ph. D.; Charles H. Day, A. E. M.; Duval La Chapelle; Frederick Charavay, M. E.; I. S. Kaufman, B. S., C. E.; I. E. Glover, B. S.; J. H. Steenson; Joshua Ward, B. S., M. E., and Captain Hugo Sundstedt.

The latter has been named design-

ing engineer of The American Eagle and his preliminary draft has received tacit acceptance. Captain Sundstedt's achievements in aeronautics have been international in scope. He left a naval career to take up aeronautics with Bleriot in 1909 and was later associated with Farman. During the war he was chief test pilot in the French Air Service. He holds honors for having made the first trans-Baltic Sea flight and Paris-Stockholm flight, among many others, and has been identified with American aeronautical activities since the close of the war.

Dr. Charles W. Burrows is a consulting engineer in New York with laboratories in Newark, N. J. He was formerly chief of the Magnetic section of the U. S. Bureau of Standards at Washington, in which post he served with professional distinction during the war, having been called to it from the department of physics at the University of Michigan. Dr. Burrows has accepted the post of Administrative Engineer and will pass on every detail of the construction and equipment of The American Eagle.

The board of consulting engineers



Airscape of the Stock Farm of Governor Warren McCray at Kentland, Indiana

includes Charles H. Day, who, as chief engineer, designed the J-1 for the Standard Air Craft Corporation and built the American Handley-Page-Caproni bomber. He is engineer in charge of structure. Duval La Chapelle, who was with Orville Wright in France and is recognized as an authority on pontoons, which constitute his especial responsibility with the American Eagle. Frederick Charavay, M. E., among the foremost designers and experts on propellers is consulting engineer on this phase of the huge American plane.

F. A. Robertson, chief engineer of the Splitdorf Electric Company, and a recognized world authority on ignition, is in charge of electrical design and installation, and associated with the foregoing in charge of power plant, controls, material, instruments and aerodynamics, are engineers and experts whose names have not as yet been made public.

The partial personnel of the engineering staff given out by Mr. Assmus includes I. S. Kaufman, B. S., C. E., who has been active as a aeronautical engineer since 1910, and who served during 1918 and 1919 with the U. S. Army Engineering Corps, receiving a prize from the U. S. Government for designing a successful night bomber; I. E. Glover and James H. Steenson, who in addition to eleven years' experience in aeronautical engineering, devoted two years to exhibition flying and passenger piloting. Joshua Ward, B. S., M. E., was named as the Washington representative and Col.

Evan Shelby as counsel.

Despite the naval and military tinge to the personnel, the American Eagle project and the competition it has invited are described, as approached purely in the spirit of sportsmanship on the premise that the contest will blaze the way for larger scale aerial commercial activities of an essentially peaceful nature and hasten the adoption of aerial cruisers for trans-oceanic passenger, mail and express business. This aspect is emphasized by the past activities of Secretary Cyril O. Assmus, through whom the announcement was issued, and who has organized and directed many cruises for the British Royal Mail Steam Packet, and the Hamburg-American companies prior to the war. The latter said of the project:

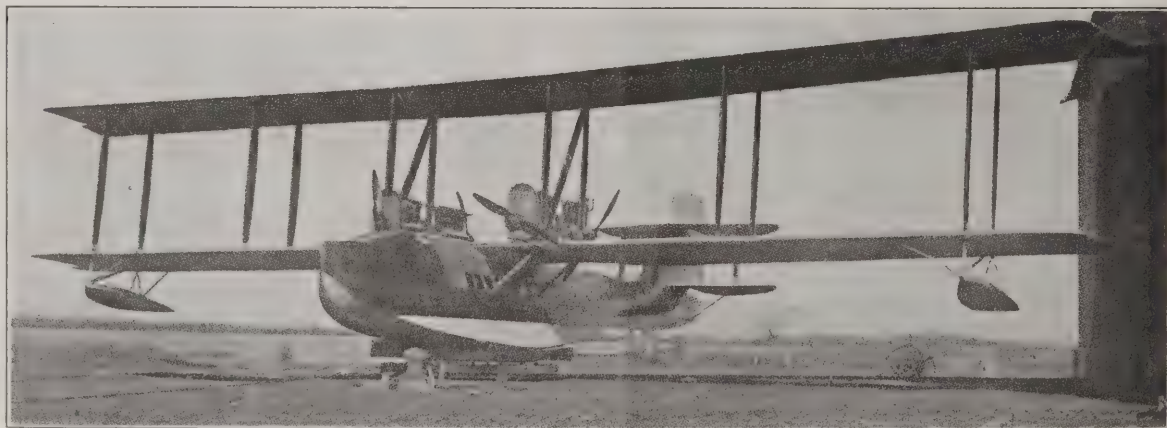
"This undertaking is simply and obvious development of the day—an elaboration of what has been done and is being done on a smaller scale. Experimental 'stunt' and 'gypsy' flyers have paved the way so thoroughly that a large number of American aeronautical experts came to the conclusion that only concerted action was necessary to circumnavigate the globe with an airship of practical commercial size to settle once, and for all time, the question of the scientific mastery of the air for other than destructive purposes.

"Work on The American Eagle has progressed in a quiet way over a considerable time. Reports of similar efforts abroad reached our ears and after deliberation it was agreed

that the most manly and sportsman-like method of approaching the subject was in laying our cards on the table for all the world and to invite international competition. This will go far to clarify the status of various prizes that have been offered from time to time for this feat, and doubtless will result in the offering of other prizes and trophies by the sportsmen of the world. It will also serve to stimulate a friendly constructive interest and enthusiasm among those who realize the airship will supplant the ocean liner for first cabin passenger, mail and express business, as distinguished from those who see in the aeroplane only an agency of war and destruction.

"We feel that we have no occasion to fear that American ingenuity and constructive genius in this field cannot hold its own against the world. In this connection the names that have become public do not tell the story of the personnel group in this project. Every inventor, engineer or manufacturer who has anything of value to offer, may contribute his idea or feature without sacrifice of proprietary rights. It will be tested for efficiency and if of superior value, will be used, making the American Eagle a great American aeronautical laboratory or clinic.

"Negotiations are pending with many prominent men and organizations for whom we have no authority to speak at this time because the negotiations have not reached the stage of completion. Now it's up to the world to try to beat America in this field."



The Pegna-Rossi-Bastianelli Seaplane. The machine, which is of nearly 100 feet span, is intended to carry a very large proportion of disposable load at the high cruising speed of 100 m.p.h. It is equipped with four Isotta-Fraschini motors of 270 H.P. each, arranged two in tandem in each of the two wing nacelles.

The Berliner Helicopter

HAVING perfected a helicopter which will rise gracefully from the ground and glide forward with the same precision as the most advanced type of aeroplane, Henry A. Berliner, a Washington inventor, is now busily engaged in further perfecting his vertical-rising airship so that it will alight with a degree of safety that will make it available for peace or war-time purpose.

The Berliner helicopter has undergone a series of tests at the flying field at College Park, Md., a suburb of Washington, before high aviation officers of the American Army and Navy and military attachés of foreign governments stationed here. All have pronounced the machine a success. In all the tests Berliner, the young inventor, has piloted the helicopter, which is capable of rising vertically from a standstill to a height of twenty feet and then advancing in a forward direction around the field without loss of distance from the ground. The machine, it is said, responded perfectly to Berliner's demands while in flight, but the inventor has not yet perfected the machine to the extent of landing from any height with the degree of safety that is required.

"We have demonstrated that our machine can rise vertically from the ground and we have further shown that it can move forward and is capable of control in flight," Mr. Berliner said today, "but the problem of landing safely is yet to be solved. Once this is solved I believe the helicopter will become as practical as the present-day aeroplanes, with the added feature of taking off in small areas and

possibly landing in the same restricted zone."

Bringing New Machine to Earth Is Problem

Mr. Berliner would not discuss the possibility of entering his invention in the competition for the \$250,000 prize offered by private British interests for the perfected helicopter. He said, however, that if he perfects his machine so that it will land with safety the future of the helicopter is assured.

Bringing the machine to earth safely, therefore, is the big problem that Berliner has set out to solve. The machine as now designed comes down with a rock-like fall when the motor is cut off. With an engine of extreme nicety of adjustment and absolute certainty of action descent might be made by simply throttling down the propeller speed gradually. As there is no engine of such dependability, other means must be found by Berliner.

The use of parachutes or any balloon-like aid would add too much weight to the machine. Another method proposed is that in coming down the propellers be so built that they can be disconnected from the engine and the angle of the blades changed so that they will offer greater resistance.

The Berliner machine resembles an aeroplane without wings. The fuselage and rudder are the same, and a Lerhone 110-horsepower rotary motor is mounted forward as in an aeroplane. On either side of the fuselage there is an upright carrying a 14-foot propeller. These two propellers revolve in opposite directions and force

the air downward, lifting the 1,400-pound machine and pilot off the ground.

Near the tail there is a small propeller, which is geared also to the motor and which tilts the entire helicopter by slightly lifting its tail. This tilt causes the forward motion of the machine. The inventor claims that with a 1,000-pound load but 3 per cent of the lift is lost in a tilt of 15 degrees, and that this loss is transferred into horizontal push of about 25 per cent of lifting power. This is a somewhat greater tilt than has been used in most of the experiments, but he thinks that a 25-degree tilt may possibly be reached safely.

Idea Follows Plan Worked on by Father

In evolving the helicopter Berliner has been preceded by his father, Emile Berliner, an inventor, who took up the old idea of constructing a machine that could rise vertically from a standstill about twelve years ago. Since then he had been experimenting, building and rebuilding it, until he was forced to give up the task about three years ago on account of illness. Henry, who is twenty-six years old and was graduated from the Massachusetts Institute of Technology, then took up the work and succeeded in making the first flight in a machine of that type.

The success of the machine is due, in part, the inventor said today, to the size of the two propellers that are placed on the machine in a position that would correspond to the outer wings of a biplane. Many have tried to use mammoth propellers, some as long as fifty feet, he said, but they derived no results.



The Berliner Helicopter in Flight

Once in the air, the helicopter moves forward with the aid of a three-foot propeller attached to the tail of the machine, which tilts it downward.

The body or fuselage, which is about twenty feet long, was taken from an aeroplane, and likewise the rudder, which guides the machine from left to right. Both father and son believe the machine has wonderful potentialities. They point out that this type of aeroplane would be especially advantageous to the Navy, as the seaplanes and flying boats now in use require a long stretch of water as a "take-off."

The helicopter, or vertical-rising air machine, is not an impossibility, and should a real use for such type arise successful ones may be seen before many years, according to Dr. Albert F. Zahm, aeronautical expert for the Navy, in an interview with the Associated Press. Had there been a need for the helicopter during the war, he said, any of several types could have been perfected, of which working models have been flown.

Dr. Zahm is an expert on design and construction of all manner of flying machines. For years he has applied his time to perfection of the aeroplane, and is well qualified to pass upon the capabilities of any.

Much interest has been shown of late in reports of successful machines of the helicopter type being perfected in both Germany and England. However, while some flights have been made, none of any consequence are reported by a machine equipped with horizontal propellers or revolving planes, designed to rise vertically from a confined space and descend on the same.

That the helicopter is possible, Dr. Zahm said, is proved by the German machine, which, rising several times to moderate heights, has carried observers, remained almost stationary while in air and descended in safety. The machine, however, has made no extended flight, such as would prove its dependability, but was tethered to the ground by a mooring rope. At times, when the motors failed, the machine dropped and the passengers saved themselves only by leaping with parachutes.

The experiments are continuing, however, with the purpose of perfecting a motor which can be depended upon to maintain the machine without sudden failure, the scientist explained, for as soon as the engine stops the machine cannot glide to the ground, as does an aeroplane, but drops vertically. In a proper descent the propellers should be whirled slowly to ease the landing.

Present hopes of attaining successful vertical flight rest mainly upon the endeavors of Mr. Berliner and of Louis Brennan, of London, whose newest machine is reported as nearing completion. He is working to win the £50,000 prize offered by the British Air Ministry for successful flight.

The helicopters upon which most experimentation has been made consist mainly of two or more propeller screws mounted horizontally on a vertical shaft, bearing engines, fuel and passengers. Equal numbers of propeller blades must revolve in opposite directions that the body of the machine may not spin like a top. The motors, tanks and body have been mounted in various positions, but the German machine has a sort of pulpit car mounted at the top of the shaft over the propellers for the operators.

Other Types of Vertical Flying Machines Offered

Whether or not this type of machine is brought to actual use, Dr. Zahm stated, at least two other types of planes that may fly vertically have been offered to the Government. This fact is not widely known.

One of these, of which Dr. Zahm observed experiments with a working model, was almost identical with the present type of plane, except that mounted behind the body were two sets of air vanes, in groups, tilted at an adjustable angle, like that of Venetian blinds.

When the power was turned on, he said, the "wash" of the air stream from the propellers pushing against these groups of vanes caused the model to rise gently vertically. The model was held in midair by the action, and when the power diminished it returned gently to earth. A full-size machine of the type, he said, would be equipped with engines of immense power in order to furnish sufficient air pressure, and when driven to a sufficient altitude the vanes would be so adjusted that horizontal motion would result. The plane could then fly in the usual manner, finally using the vanes again to descend vertically.

The other type offered to the Army, he said, was of the present wing plan, equipped with three propellers, two placed far out toward the wing ends and with vertical rudders and ailerons similar to those in use. The quicker lifting power was to be gained by having the wash of the central propeller act upon elevators on the tail of the body, while the side propellers would wash against the special ailerons on the wing tips.

When in the air, Dr. Zahm con-

tinued, this machine could maneuver exactly as does the ordinary plane, cut figures and do "stunts," besides being able to rest motionless in any desired position—vertical, with nose up, if need be.

The best feature, he said, is that both planes of the new types are entirely feasible and can be constructed at any time. In fact, several European inventors and manufacturers are patenting designs of the second type, notably the Frenchman Bleriot, one of the pioneers of aviation.

Cost and Weight Called Drawbacks to Construction

Experts for the Government studied the second type during the war, it was explained, but the matter went no further.

The general drawbacks of their construction, Dr. Zahm said, were, first, the great cost; second, the increased weight of the machines as compared with present engine efficiency; and, third, the need of developing motors with greater power and less weight per horsepower and with a greater amount of dependability. As it is, he said, a successful helicopter may be flown to any height, but the operators will never know when the engine will give a cough and die away.

The German experimenters, however, he added, have in part overbalanced this disadvantage. It has been determined by experiment that a propeller of three or four narrow blades, caused to revolve by the air pressure resulting from a forced descent with a dead engine, will develop as much parachute resistance as a solid disc of the diameter of the blade spread. In addition, the German machine is equipped with air cushions on the landing bottom so that the landing, if forced, may be made comparatively easy.

Means of steering experimental helicopters, and of which one would undoubtedly be used in a successful machine, are two. The first is a means of tilting the propeller's shaft or the whole machine, when it will travel in that direction; the second being the use of vanes similar to those already described. With the latter, Dr. Zahm thinks, a helicopter sufficiently powered should be able to cut capers in the air as aviators do at present.

Any of the types advanced would, in warfare, be of great use in bomb dropping or for observation. The main disadvantage, that of being a good target for artillery fire while stationary, could be offset by quickness of movement from point to point and short stops while hovering.

Detroit's Aerial Contests

THE Aviation Country Club of Detroit announces the sixth annual contest for the Curtiss Marine Flying trophy, first annual contest for the Detroit News Aerial Mail trophy, first annual contest for the Aviation Country Club of Detroit trophy, first annual contest for the Liberty Engine Builders' trophy, and the third annual contest for the Pulitzer trophy. This aviation meet was primarily scheduled for the purpose of holding the third annual Pulitzer Race. However, in order to arouse the widest possible interest in flying and stimulate the development of commercial aviation, the plans have been elaborated to include diversified types of planes. The intention is to attract a varied field of land and water entries to compete for prizes to be awarded on the basis of the best combination of high speed and improved construction without, however, having recourse to complicated rules incapable of being satisfactorily applied.

Event No. 1

The Detroit Aerial Water Derby, including Curtiss Marine Flying Trophy, Monday, September 4th. Cash Prizes: First prize, \$1,200; second prize, \$600; third prize, \$200.

1. The trophy shall be perpetual and competed for annually by seaplanes and flying boats.

2. The contest shall be in the nature of a race either around a closed circuit or from point to point. The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.

3. The trophy shall be awarded each year to the aero club represented by the pilot of the winning machine, and this club

shall be entitled to the possession of the trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Curtiss Marine Trophy, or of assigning this privilege, under sanction, to any other club or organization.

1. CONDITIONS OF CONTEST:

(a) Factor of safety—Monoplanes, 6 as loaded for start of race; biplanes, 4 as loaded for start of race.

(b) Air speed greater than 70 miles per hour, as loaded for start of race.

(c) Visibility and maneuverability (water and air) which in opinion of Contest Committee, Detroit Aviation Society, is not a menace to other contestants or spectators.

2. DISTANCE:

Approximately 160 miles—eight times around a closed course of 20 miles.

3. (a) START:

The starting signal will be given at 3 p. m. Planes to be in their allotted places at 2 p. m. Pilots' meeting for the final instructions to be announced later.

(b) POSITION AT START:

Planes competing for class and invitation prizes in addition to Curtiss Marine Trophy will be sent away together in a class, the faster classes starting before slower. Competitors for Curtiss Marine Trophy only will be sent away together after the classes.

(c) METHOD OF START:

Contestants will be lined up along the shore in shallow water for the start. The starter will assign an assistant starter to each plane who shall raise the signal flags for its pilot, as follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 2:45 p. m. When the motor on each plane is running, the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 3 p. m., the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds; each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red starting flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be started after a delay of two hours.

4. THE FINISH:

The finishing time will be taken when each plane flies across the finishing line between the marks defining this line, after having completed the full course, 160 miles.

5. THE WINNER:

Of each first place shall be the pilot which has completed the full course in the shortest elapsed time, and of each second place the second best time, etc., provided the pilot is not disqualified. The Curtiss Marine Trophy will be awarded to the club represented by the pilot and the prize money paid to the entrant of the winning seaplane or flying boat. Agreements between pilots and entrants as to their proportional share of the prize money will be upheld by the Contest Committee, who will pay the prize money in accordance with agreements in writing between pilots and

entrants, presented to the Contest Committee prior to the race or within 24 hours after the finish of the race.

6. QUALIFICATIONS:

No seaplane or flying boat may take part in the contest unless it is piloted or commanded by a pilot, who must be on board and who must be furnished with a license issued by the Contest Committee of the Aero Club of America. (F. A. I. Rules, Art. 67.) Every person furnished with pilot's certificate of F. A. I. may obtain license issued optionally by Contest Committee, Aero Club of America. (F. A. I. Rules, Art. 70.) A license will be valid until December 31st of the current year. The Contest Committee, Aero Club of America, may, upon the occasion of any competition or test, issue temporary license as pilot for this one test only to any person whose qualifications it considers sufficient. (F. A. I. Rules, Art. A-28.)

7. DISQUALIFICATIONS:

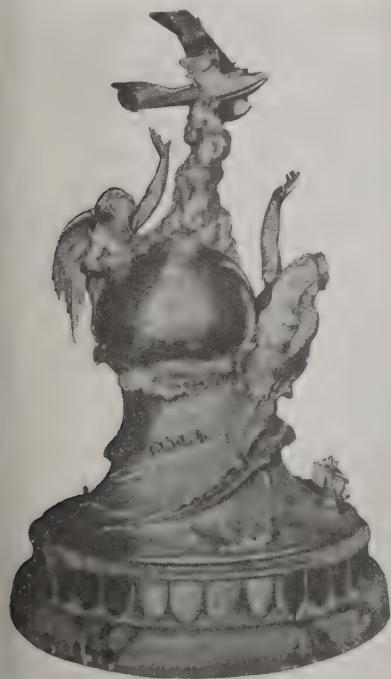
Any contestant breaking the above rules of the race, or subsequent ones which may be sent out in writing, shall, upon recommendation of the judges, be disqualified.

"Every person organizing or taking part in a sporting event of whatsoever nature is supposed: (1) "To know the present regulations (F. A. I. Rules) thoroughly." (2) "To agree to submit without restriction to the consequences that result therefrom." (F. A. I. Rules, Art. 7.)

8. RULES OF THE RACE:

(a) Upon receiving the getaway signal for the start, pilots shall hold a straight course and not cross or attempt to cross in front of the planes on either side.

(b) From a standing start contestants will fly around the first four laps of the course, and during laps five, six and seven will be obliged to alight on the water and while running along the surface of the



The Curtiss Marine Trophy



The Pulitzer Trophy

water enter into and pass through, in the proper direction, the water controls which shall be designated by moored markers on both sides.

Note: (There will be only one water control in the shape of a hairpin turn.) The entrance into and exit from this control will be located sufficiently near the turning mark that anything but normal landing speeds or normal taxiing speeds will overrun the turning mark and result in loss of time.

(c) While within the markers bounding the water controls, the contestants must maintain constant contact between the water and fixed surfaces of the principal flotation gear (wing or tail pontoons, or water rudder, or any other adjustable, movable or flexible attachment is not sufficient contact with the water under this rule).

(d) A plane overtaken, both planes being in the air, must hold its altitude and a true course, in order that it may not in any way impede or interfere with the faster overtaking plane.

(e) A plane overtaking a slower plane, both planes being in the air, shall never pass or attempt to pass between that plane and any pylon or object used to mark a turning point.

(f) Within the water controls, both planes being on the water, the overtaking plane must pass to the right, and all mechanics of competing planes must look to the rear and warn pilots of an overtaking plane. Pilots of overtaken planes must keep to the left and result in loss of time.

(g) The finishing line must be crossed in flight—not on the water—and, after crossing the finishing line, all planes shall continue on their course until they have attained sufficient altitude to enable them to turn and land without crossing the course or finishing line.

(h) No contestant shall start before he receives the getaway signal.

(i) Pilots shall pass outside all turning points and in plain view of officials stationed at each point, and at an altitude of not more than 250 feet.

Fouling a Mark. "Any contestant who has failed to turn a stake properly may validly continue on the circuit provided he makes a complete turn of the said stake and then continues his trip in the same direction." (F. A. I. Rules, Art. 115.)

(j) No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

9. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of Detroit Aviation Society within twenty-four hours after the finish of the race. (F. A. I. Rules, 78, 79, 80.) (Appeals. See F. A. I. Rules, Art 178-179.)

10. NUMBERS:

Each plane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of lower wing and on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering over twelve inches in height.

11. ADVERTISEMENTS:

"Competitors are forbidden to display on their apparatus or material any commercial advertisement except the trade-mark of the constructor of the apparatus." (F. A. I. Rules, Art. 89.)

Note: (The word plane as used in these rules means flying boats or seaplanes.)

ADDITIONAL PRIZES:

The (to be announced later) prizes for greatest air speed will be awarded to the contestant who, during the Curtiss Marine Trophy race, completes laps 2, 3 and 4 in the shortest total elapsed time.

The first lap is not included because of the standing start.)

Additional prizes will be awarded for class or invitation races to be announced by the Contest Committee of the Detroit Aviation Society after entries have closed.

(a) CLASS RACES:

Four or more planes of the same design and equipped with the same motor shall constitute a class.

CLASS RULE:

Planes eligible for class races are those constructed under the same design and general specifications and not altered to materially change these specifications, nor to prevent the interchange of any corresponding part or parts of any two planes.

Furthermore, should any interchange of corresponding part or parts be directed under this rule, the plane must remain the same after the interchange from the standpoint of design and operation.

EXCEPTIONS:

Stream-lining which does not alter the structure of the part or parts stream-lined.

Motors eligible for class races are determined by the above rule and these exceptions.

1. Stream-lining which does not alter the structure of the part or parts stream-lined.

2. Motors may be equipped with any make or design of propeller, ignition, spark plugs, carburetor, including intake manifold, exhaust manifold, gasoline and oil systems.

(b) INVITATION RACES:

The Contest Committee of the Detroit Aviation Society may invite any of the entrants to compete for a special prize.

Event No. 2

Detroit News Aerial Mail Trophy, Thursday, September 14. Cash prizes: First prize, \$1,200; second prize, \$600; third prize, \$200. Race for large-capacity, multi-motored aeroplanes.

1. CONDITIONS OF CONTEST:

(a) Factor of safety—Monoplanes, 5 as loaded for start of race; biplanes, 4 as loaded for start of race.

(b) Air speed greater than 75 miles per hour.

(c) Carrying contracted, specified or advertised loads.

2. DISTANCE:

Approximately 264 miles—four times around a closed course of approximately 66 miles, starting at Selfridge Field, passing over captive balloon located approximately 18 miles away, at approximately 5,000 feet altitude, thence to Aviation Country Club's Field, thence to Packard Field, and then returning to Selfridge Field.

3. (a) START:

Starting signal will be given at 11 a. m. Aeroplanes to be on their allotted places on the Field at 10 a. m. Pilots' meeting for final instructions will be announced later.

(b) POSITION AT START:

Planes competing for the Detroit News Aerial Mail Trophy will be sent away together in a flight, or series of flights, dependent on the number of entrants and conditions at time of start. However, any entrant will be permitted to start alone after all flights if this request is made to the Contest Committee in writing before Sept. 9th, 1922.

(c) METHOD OF START:

The starter will assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot, as follows: The starting signal (for motors only), a red flag, will be raised by the

chief starter at 10:45 a. m. When the motor of each plane is running the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 11 a. m., the starter will raise, in addition to the red starting flag; the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the blocks from under the wheels. Each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before 5 p. m.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks defining this line, after having completed the full course, approximately 264 miles.

5. WINNER:

The winner of the first place shall be the pilot who has completed the full course in the shortest elapsed time, and second place the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS:

All pilots must hold an Aviator's license issued by the Federation Aeronautique Internationale and duly entered upon the Competitor's Register of the Aero Club of America.

7. RULES OF THE RACE:

(a) Pilots must hold a straight course after starting until they have gone the distance to be specified and marked.

(b) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(c) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(d) Pilots must attain the altitude of the captive balloon each lap, and in passing shall do so to either side in order that the observers in the basket may clearly see the aeroplane's number. Any pilot not having sufficient altitude upon reaching the balloon shall continue to climb, but must make a circle so that when passing the balloon the second time the aeroplane will be headed in the line of flight of the course.

(e) All pylons marking turning points must be passed at an altitude not greater than 400 feet.

(f) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the field, and land in that part of the field assigned for landing and in so doing shall not cross the course or finish line.

(g) Any contestant breaking any of the foregoing rules of the course, or subsequent ones which may be officially announced in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of the Detroit Aviation Society within twenty-four hours after the finish of the race.

9. NUMBERS:

Each aeroplane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of the lower wing on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering or lettering over 12 inches in height.

10. No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

Event No. 3

Aviation Country Club of Detroit Trophy, Thursday, September 14. Cash prizes: First prize, \$1,200; second prize, \$600; third prize, \$200. Race for light commercial aeroplanes.

1. CONDITIONS OF CONTEST:

(a) Factor of safety—Monoplanes, 5 as loaded for start of race; biplanes, 4 as loaded for start of race.

(b) Air speed greater than 80 miles per hour.

(c) Arranged to seat three or more passengers, including pilot, and carrying their capacity load; 160 lbs. of ballast must be carried in place of each passenger omitted.

2. DISTANCE:

Approximately 264 miles—four times around a closed course of approximately 66 miles, starting at Selfridge Field, passing over captive balloon located approximately 18 miles away at approximately 5,000 feet altitude, thence to Aviation Country Club's Field, thence to Packard Field, and then returning to Selfridge Field.

3. (a) START:

Starting signal will be given at 12:00 noon. Aeroplanes to be on their allotted place on the Field at 11:30 a. m. Pilots' meeting for final instructions will be announced later.

(b) POSITION AT START:

Planes competing for the Aviation Country Club of Detroit Trophy will be sent away together in a flight, or series of flights, dependent upon the number of entrants and the conditions at the time of start. However, any entrant will be permitted to start alone after all flights if his request is made to the Contest Committee in writing before Sept. 9th, 1922.

(c) METHOD OF START:

The starter will assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot as follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 11:45 a. m. When the motor of each plane is running the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 12:00 noon, the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the blocks from under the wheels. Each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced

down, provided it can do so before 5:30 p. m.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks defining this line, after having completed the full course, approximately 264 miles.

5. WINNER:

The winner of the first place in the race proper shall be the pilot who has completed the full course in the shortest elapsed time, and second place the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS:

All pilots must hold an Aviator's license issued by the Federation Aeronautique Internationale and duly entered upon the Competitor's Register of the Aero Club of America.

7. RULES OF THE RACE:

(a) Pilots must hold a straight course after starting until they have gone the distance to be specified and marked.

(b) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(c) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(d) Pilots must attain the altitude of the captive balloon each lap, and in passing shall do so to either side in order that the observers in the basket may clearly see the aeroplane's number. Any pilot not having sufficient altitude upon reaching the balloon shall continue to climb, but must make a circle so that when passing the balloon the second time the aeroplane will be headed in the line of flight of the course.

(e) All pylons marking turning points must be passed at an altitude not greater than 500 feet.

(f) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the Field, and land in that part of the Field assigned for landing and in so doing shall not cross the course or finish line.

(g) Any contestant breaking any of the foregoing rules of the course, or subsequent ones which may be officially announced in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of the Detroit Aviation Society, Inc., within twenty-four hours after the finish of the race.

9. NUMBERS:

Each aeroplane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of lower wing on each side of the fuselage, clear of the wing in characters as large as possible. It shall have no other numbering or lettering over 12 inches in height.

10. No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

11. CONDITIONS OF TRIALS:

Trials for operation of self-starter and muffler for planes thus equipped—also the examination for bonuses given for complete accessibility to: Oil, water, gas-filling caps, draining plugs and filtering screens, ignition breakers and distributors, and carburetor adjustments and inspection—will be conducted from August 31st to September 13th, 1922.

12. Any contestant failing to make these

trials during this period shall, at the discretion of the Contest Committee, forfeit the rights to the points which he may have gained—even though the trials are made after the race.

13. This trophy and cash prizes are to be awarded on points, given as follows:

(a) To the winner of the race proper—600 points. To those finishing within twenty minutes of the winner their pro rata share of points on the basis of a loss of 30 points per minute late.

(b) A bonus of 100 points will be given to each aeroplane carrying an operative self-starter.

(c) A bonus of 100 points will be given to each aeroplane carrying a muffler which effectively muffles the motor at a height of 1,500 feet, in normal flight.

(d) A bonus of 50 points will be given to each aeroplane having complete accessibility to the following: Oil, water, gas-filling caps and drain plugs.

(e) A bonus of 100 points will be given to each aeroplane having complete accessibility to the following: Spark plugs, oil and gasoline screens, ignition breakers and distributors, and carburetors in respect to both adjustment and inspection.

In the event of a tie in the scores of two aeroplanes, the aeroplane having received the greatest number of points in the race shall receive an extra point.

Event No. 4

Liberty Engine Builders' Trophy, Friday, September 15. Cash prizes: First prize, \$1,200; second prize, \$600; third prize, \$200. Race for observation type (2-passenger) aeroplanes.

1. CONDITIONS OF CONTEST:

(a) Factor for safety—Monoplanes, 5 as loaded for start of race; biplanes, 4 as loaded for start of race.

(b) Air speed greater than 90 miles per hour.

(c) Carrying U. S. Government specified load for this type of aeroplane.

2. DISTANCE:

Approximately 240 miles—six times around a closed course of approximately 40 miles, starting at Selfridge Field, thence west to captive balloon, thence to Packard Field and returning to Selfridge Field.

3. (a) START:

Starting signal will be given at 11:00 a. m. Aeroplanes to be on their allotted places on the Field at 10 a. m. Pilots' meeting for final instructions will be announced later.

(b) POSITION AT START:

Planes competing for the Liberty Engine Builders' Trophy will be sent away together in a flight, or series of flights, dependent upon the number of entrants and the conditions at the time of start. However, any entrant will be permitted to start alone after all flights if this request is made to the Contest Committee in writing before Sept. 9th, 1922.

(c) METHOD OF START:

The starter shall assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot as follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 10:45 a. m. When the motor of each plane is running the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 11:00 a. m., the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the bricks from under the wheels. Each

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Annual Meeting of the Aeronautical Chamber of Commerce

THE annual meeting of the Aeronautical Chamber of Commerce of America, Inc., was held at the executive offices, 501 Fifth Avenue, New York City, July 11. The organization, which was formed the first of the year, with a charter membership of one hundred, reports an increase of nearly 100 per cent in six months. Preparations for flying meets in Chicago in August and Detroit in October were announced.

The following Governors were unanimously re-elected: Grover C. Loening, Loening Aeronautical Engineering Corp.; Charles F. Redden, Aeronautical Airways, Inc.; C. C. Witmer, Airship Manufacturing Co., of America; B. E. Bushnell, Stewart Hartshorn Co.; S. S. Bradley, Manufacturers Aircraft Association, Inc.; Charles H. Colvin, Pioneer Instrument Co.; S. M. Fairchild, Fairchild Aerial Camera Corp.; John M. Larsen, J. L. Aircraft Corp.; Lawrence Sperry, Lawrence Sperry Aircraft Corp.; Frank H. Russell, Curtiss Aeroplane & Motor Corp.; F. B. Rentschler, Wright Aeronautical Corp.

General Manager's Report

Following is the annual report made to the members of the Aeronautical Chamber of Commerce by the General Manager, S. S. Bradley.

Membership

Our organization was formally announced Jan. 1, last, with 100 charter members. In the first six months we have increased our membership to 176, divided as follows: Class A—19; Class B—39; Class C—117. Since the last meeting of the Board of Governors, 7 Class B and 13 Class C members have been added. In addition, full and complete co-operation has been obtained with two important groups in the lighter-than-air field. Among the new members are the following:

Electric Storage Battery Co., Philadelphia, Pa.

Endicott Forging & Mfg. Co., Endicott, N. Y.

Hamilton Aero Mfg. Co., Milwaukee, Wis.

Macwhyte Co., Kenosha, Wis.

Radio Corp. of America, New York.

Standard Oil Co. (Indiana), Chicago, Ill.

Tide Water Oil Sales Corp., New York.

Flying Meets

We have co-operated in holding two flying meets this spring; the first at Garden City on April 30, and the

second at Baltimore on May 30. The attendance at the Garden City Meet was conservatively estimated at 20,000; the one at Baltimore, 5,000.

In addition to the above, we have an agreement with the Detroit Aviation Society contemplating our assistance in the management of the races at the flying meet to be given in Detroit next October.

General Contact

Washington: Close liaison has been maintained with official Washington. Representatives of the Chamber held a conference with President Harding on April 13, 1922, at which time the need of aerial law and an aggressive aerial policy was urged. Following this conference the President wrote a most important letter indicating the continuation and extent of his interest in the subject of aviation and our organization. A copy of his letter is attached hereto.

War and Navy Departments: Our contact with the Air Services has followed lines with which our members are familiar, and recently has been particularly active due to the participation of the Departments in the races at Detroit next fall.

For some time we have emphasized upon the War Department the necessity of great care in the release and sale of surplus material. In the past sales of surplus aeronautical material have resulted in a number of fatal accidents, due to the failure of machines in flight. We are therefore gratified to report that such a policy has now been adopted by the Department and that every precaution is being taken, in the absence of air law, to prevent unairworthy material being sold to the public.

We have consistently and persistently advocated recognition on the part of the public and the Government that we must have an aircraft industry before we can have aviation. We have recently seen many evidences of increased acceptance and appreciation of this fact.

During the month of May we completed and submitted to the War Department an extensive aeronautical industrial survey. This survey was based upon a questionnaire originating with the Secretary of War, which we addressed to our members. We have received various acknowledgments from officers in the Air Service and the Office of Secretary of War, advising us that the information thus gathered is greatly appreciated by the Department.

Post Office Department: On Janu-

ary 6, February 21, April 28 and 29 hearings were held by the House Committee on the Post Office and Post Roads on bills introduced by Representatives Steenerson and Keller proposing authority for air mail contracts. At the request of the Post Office Committee, we sent out a questionnaire to our members and to 10 Chambers of Commerce throughout the United States. A digest of the replies was prepared and submitted to us at the hearings. All of which have been printed in the official report and distributed to our members. Through contact with the office of the Air Mail Division, we have advocated and encouraged the plan to develop night flying of the Air Mail.

Department of Commerce: We have prepared and submitted to the Secretary of Commerce a summary and report of commercial aviation in the United States during the past year. This was submitted to the Secretary of Commerce on April 10, and after being studied by the Department the report was released by Secretary Hoover to the newspapers on June 20. This report also provided material for distribution to Congressional Committees. It has also been very generally helpful as forming the basis for a very large number of constructive editorials in the newspaper throughout the country.

Aerial Legislation

Our work in connection with the Wadsworth Bill, S.3076, has been continuous. In addition to our interview with President Harding, we subsequently had conferences with the Assistant Secretary of Commerce, Mr. Huston; Chairman Winslow of the House Committee on Interstate and Foreign Commerce; Dr. Klein, the head of the Department of Foreign and Domestic Commerce; and Judge Lamb, Solicitor of the Department of Commerce. At Judge Lamb's request we called, at very short notice a conference of our members at our offices in New York. At this time the entire subject was discussed in detail and it was planned that following this conference final recommendations from the Department of Commerce were to be prepared and submitted to Congress. The advancement of the bill is now delayed on account of a suggestion that has been made to give consideration at this time to the question of the desirability of consolidating all aeronautical activities of the Government in a single department. This is regarded as very unfortunate as it will delay final consideration very greatly.

Trade Association Conferences

On April 13 we participated in the National Trade Association Conference with Secretary Hoover. A representative of our office was appointed to serve with the National Automobile Chamber of Commerce and the Motor and Accessory Manufacturers' Association, to prepare a foreign trade booklet, to be distributed by the Department of Commerce throughout the world. Copies of this pamphlet have been sent to our members.

On May 16 to 18 we attended meetings of the Chamber of Commerce of the United States. As members of this body, our activities fall within the Department of Transportation and Communication. The manager of this department, J. R. Bibb, is assisting us in establishing contact with the various local Chambers of Commerce throughout the United States for the purpose of enabling us more effectively to extend our educational work.

We are finding increasing opportunities to extend our work and establish close contact with local commercial organizations throughout the country. Due to the interest aroused by us in the Air Mail hearings, the Merchants' Association of New York City sent a representative to attend the hearings in Washington. Following this, which coincided with a request for data from the Chief of the Service, the Merchants' Association decided to appoint an Aeronautics Committee. We had the privilege of conferring with them relative to the personnel of this group. As a result, a member of our organization has been requested by Lewis E. Pierse (president of the Irving National Bank), president of the Merchants' Association, to act as a member of this committee, with a number of very prominent and influential business men whom they have selected for this service.

We have maintained very close relations with the Chambers of Commerce of Boston and Philadelphia. In Philadelphia a representative of our office addressed the representatives of their organization and obtained places on the Aviation Committee for two of our members who are in business in Philadelphia. In Boston we have co-operated with the Chamber of Commerce in their successful effort to secure through the State Legislature an appropriation providing for the establishment of a municipal airport in that city. A letter from this organization, thanking us for our support and co-operation, expresses the conviction that our activity had a very great deal to do with the successful outcome of this

movement. We have participated in similar propositions with Chambers of Commerce of Baltimore, with the Aero Club of Illinois, the Chicago Association of Commerce, and other organizations in Burlington, Vt.; Brunswick, Me.; Kansas City, Mo., and Hartford, Conn. A representative of the Chamber addressed the Aero Club of Hartford on this subject of municipal landing fields a few weeks ago.

Except for those members who are in frequent contact with our office, there is probably very insufficient appreciation of the extent to which our offices are used as a meeting place for the exchange of ideas and discussion of general questions affecting the art and industry. There is a constant flow of visitors, the facilities of the library are in constant and increasing demand, questions affecting individual members and the industry as a whole are submitted to us for consideration and advice, with the result that the organization acts as a stabilizing and at the same time stimulating agency, with a constant tendency toward straight thinking and harmonious co-operation throughout the entire field. While this places a great tax upon the personnel of the office, making it at times very difficult to handle the correspondence and other details of routine, we feel that it is very essential that this work be maintained. One tangible result of this sort of contact that must be apparent is in the quality of the publicity that we are getting. Without the advantages of a clearing house, such as our offices afford, there would be a vast amount of misinformation released and printed. The amount of this sort of material, based upon rumor or suspicion, or hope or expectation, that is arrested and diverted each week is very considerable.

Publicity

Our activities in this field have been carried on along the lines with which members are all familiar. In some respects the work has been expanded. On our initiative arrangements were made for the broadcasting of aeronautical information from the great radio station on Staten Island. This was made possible through the courtesy of the Radio Editor of the New York *Tribune*, Jack Binns. Within the last few weeks we have supplied thirty magazine writers with material and photographs for aeronautical stories. Motion pictures of aeronautical events, which we have either arranged directly or have assisted, are running each week. Aeronautical photographs have been given to the news photo agencies two or three times a week, and at frequent inter-

vals stories of current aeronautical interest are supplied to the Associated Press, the International News, the United Press and all foreign news syndicates with headquarters in New York.

We frequently learn, some time after the event, that various members have participated or had knowledge of important aeronautical news stories, where the opportunity has been missed of utilizing our facilities in securing proper publicity, due to failure to notify us of the event at the time. The members are particularly requested, whenever practicable, to report to this office promptly any event in aviation that appeals to them as being desirable publicity. We cannot promise that each story reported will be featured, but you may be certain that, to the best of our ability and judgment, the matter will receive prompt attention.

Year Book

The Year Book is now ready for distribution. Members are requested to order Year Books promptly if they have not already done so. This year's edition will be particularly valuable due to the Engine Division in the Design Section. This consists of 18 full pages of line drawings of historical and contemporary engines.

Bulletin Service

Every effort is being made by the Chamber to eliminate waste motion, to establish economies and yet maintain our service. The sales, library, Congressional and other memoranda you are familiar with. To meet a real demand, especially from the Class C members, and also to provide a medium for the dissemination of data of general interest to all members, a new series of bulletins has been established to be known as "Information." This bulletin, the first of which was issued in June, will be produced the first of each month and sent to the entire membership. This is also used for publicity purposes.

New Projects

Detroit Races: We have an agreement with the Detroit Aviation Society to co-operate with them in the management of the races at the time of the contest for the Pulitzer Trophy in October of this year. A representative of our office will attend to the details of management of the races beginning July 20 and ending October 20, and this office will, either from New York or Detroit, handle and direct all publicity.

Chicago Meet: Through the incorporation, a few weeks ago, of the Chicago Aeronautical Bureau, the situation in Chicago crystallized into

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The 18-Ton Parseval Semi-Rigid Airship "PL27"

ALTHOUGH built as long ago as 1916, there are several reasons why the Parseval type "PL27," designed and built by the Luftfahrzeug-Gesellschaft of Bitterfeld, is of sufficient interest to merit a fairly detailed description at the present time. In the first place, the airship was one of the largest semi-rigids ever built, being only very slightly smaller than the ill-fated "Roma," purchased by America from Italy some time ago. Secondly, her design was one representing a considerable departure from previous German non-rigid practice, approaching, in fact, more to the Italian than to previous German types. In spite of the accident to the "Roma," this type of airship is thought by many to have a very considerable future before it, and it is open to discussion whether the world, led by Germany, was right in deciding in favor of the rigid type of ship. In Germany at the present time, there is a strong opinion that the limits in non-rigid and semi-rigid airships have in no way been reached, and certainly one could enumerate several advantages which these types possess as against the rigid. One very important item is that of cost, and in this respect the non-rigid, and, to a somewhat smaller extent perhaps, the semi-rigid compares very favorably indeed with the rigid. The very expensive Duralumin framework is avoided, which at once means a great saving. Col. Cave-Browne-Cave, one of our soundest, and certainly our most persistent and eloquent advocate of the non-rigid airship, stated in one of his admirable lectures before the Royal Aeronautical Society that, according to his calculations, six non-rigids, each of 500,000 cubic feet capacity, could be built for the price of one rigid of 2,000,000 cubic feet capacity. In other words, with the non-rigid, we

should get an extra million cubic feet capacity for the same money.

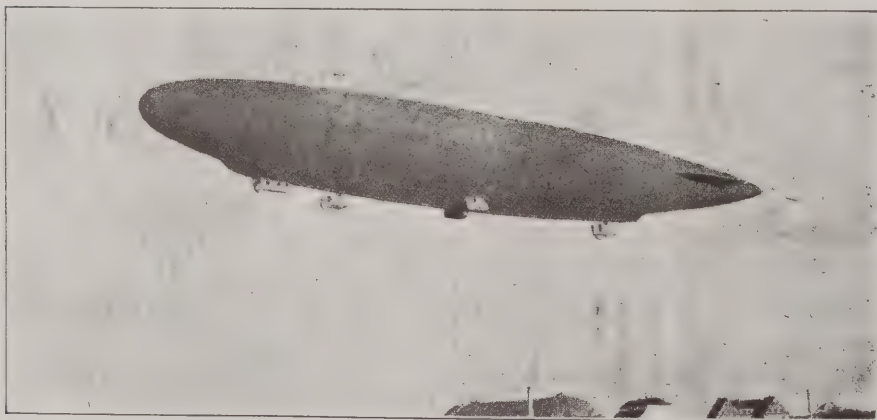
Then there is the question of useful load. Here again Col. Cave-Browne-Cave indicated that a greater percentage of useful lift is obtained in the non-rigid than in the rigid, owing chiefly to the absence of the hull structure. Thus the point where the structure weight is no more than 50 per cent of the total lift is reached in the non-rigid with the half-million cubic feet ship, whereas in the rigid it is not attained until one comes to sizes of about two million cubic feet. It would, therefore, appear that we may have been on the wrong track in pinning our faith almost exclusively to the rigid type. With things as they are at present, the question of the purchase, running and upkeep of a rigid is a big item. It is, at least, open to doubt whether we should not be better advised in making a start on airship services with types other than the rigid. As regards safety, there is probably little to choose between the types, and the non-rigid, apart from the advantages already outlined, has another in that, when not in use, it can be deflated and stored away in the corner of a shed. A rigid airship occupies as much space when deflated as it does when inflated. Furthermore, in the case of a forced landing, the non-rigid, and the semi-rigid which has its keel built in sections, can be packed up and sent home. The rigid, if it should be forced down from any cause, would almost certainly have to be written off as a total loss.

There is a great deal more which could be said about non-rigid and semi-rigid airships in general, but sufficient has, we think, been said to indicate that, as it has now been proved that these types need not be restricted to small airships, this class of airship deserves more considera-

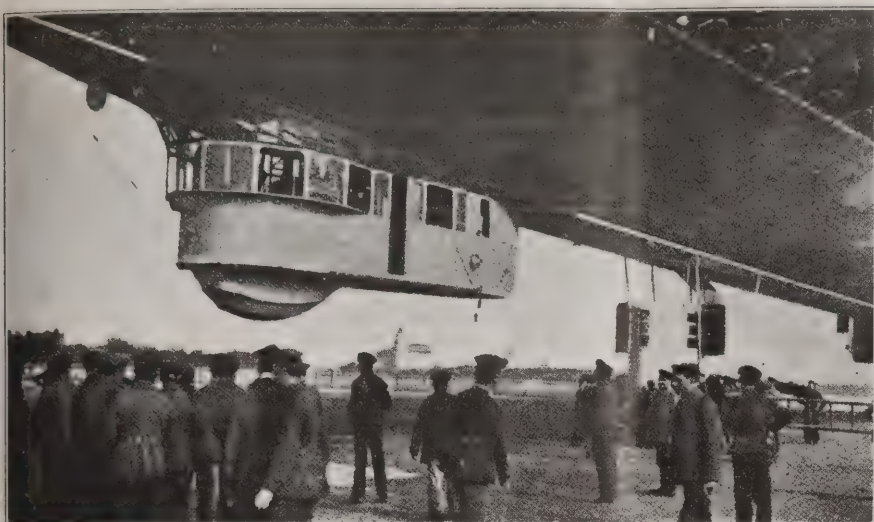
tion, from a commercial aviation point of view, than it has received in the past.

The Parseval "PL27" has an overall length of 157 meters (515 ft.), maximum diameter of 19.6 meters (64 ft. 4 ins.), a greatest circumference of 61.55 meters (202 ft.), a height of 26.5 meters (87 ft.), a cubic capacity is 31,300 cubic meters (1,104,000 cubic ft.) and the disposable lift is approximately 18,000 kilograms (nearly 18 tons). Assuming a lift of 65 lbs. 1,000 cubic ft. of hydrogen, the total lift would be approximately 32 tons, so that the possible lift is 56 per cent of the gross lift, which is considerably better than the figure of 50 per cent given by Col. Cave-Browne-Cave for a 500,000 cubic ft. ship. The allocation of 18 tons of lift would, of course, depend upon the purpose for which the airship was intended. For a very long flight a great proportion of the lift would be taken up by the fuel. For shorter distances the lift which could be set aside for paying load would increase. If the route on which the ship was used were to be divided into stages of approximately 1,000 miles each, the "PL27" could carry a crew of seven, sufficient fuel to leave a safe margin, and, in addition, have accommodation for about twenty-five passengers. It will be seen that, as regards earning capacity, the "PL27" should be a very useful craft as a passenger and cargo ship, especially as her cruising speed is said to be about 60 m.p.h. It is estimated that these airships could be built in England for not more than £30,000 each, and if built in batches the cost should be even lower. This, by reducing the length of the stage flown to approximately 1,000 miles, would be much more economical service than is possible with rigid airships, capable of doing the London-Cairo run without landing, were employed. In this way, the time for the journey to Australia, for instance, would be somewhat increased, but, on the other hand, it is at least conceivable that greater revenue would be forthcoming, as it should be easier to fill the ships with passengers for shorter distances over portions of the route.

As regards the design and construction of the Parseval "PL27," this ship is, to some extent, based upon the Italian designs in which there is a keel structure running the greater part of the length of the ship, and to which are attached some of the heavier local loads such as petrol and water tanks, central eng-



The 18-Ton Parseval Semi-Rigid Airship "PL27"



View of the forward position of the airship, showing the control car

ars, etc. This structure is so designed that its parts form, as it were, the links of a chain. In the "PL27" the keel, which is about 330 ft. long, is divided into fifty-two separate cells or units, the whole being so designed that the keel can resist longitudinal loads, but not bending moments, owing to the manner of joining the cells to each other. The keel is built up of a tubular framework, consisting of four main longitudinals, struts and wire bracing.

Three of the cars, the control car and the front and rear engine cars, are attached direct to the keel, while the two side engine cars are slung by cables from the envelope, and steadied laterally by struts to the keel. The attachment of the keel to the envelope is by rigging wires and fabric. As already mentioned, the keel serves to support, in addition to the three cars, the petrol tanks and water ballast bags.

The latter are of two kinds. One is known as "trouser" (*Hosen*) bags, and are emptied singly by means of a ripping line from the control car. The other kind has valves, and is emptied, also from the control car, two at a time. All the bags are of 200 kilogs. (440 lbs.) capacity. The "trouser" bags are mounted four forward and two aft. The ordinary bags, of which there are thirty-six, are distributed along the keel, the valves of every two bags being connected to one control line, so that with these 880 lbs. of water is discharged at a time. The total amount of water ballast carried is thus 8,400 kilogs. (18,500 lbs.).

The petrol tanks are hung in the keel, as shown in one of the accompanying photographs. Normally, thirty petrol tanks are carried, twenty-six main tanks and four gravity tanks, one for each engine. The capacity of each tank is 200 kilogs. (440 lbs.), so that normally the total petrol capacity is 13,200 lbs. (nearly 2,000 gals.). Provision is,

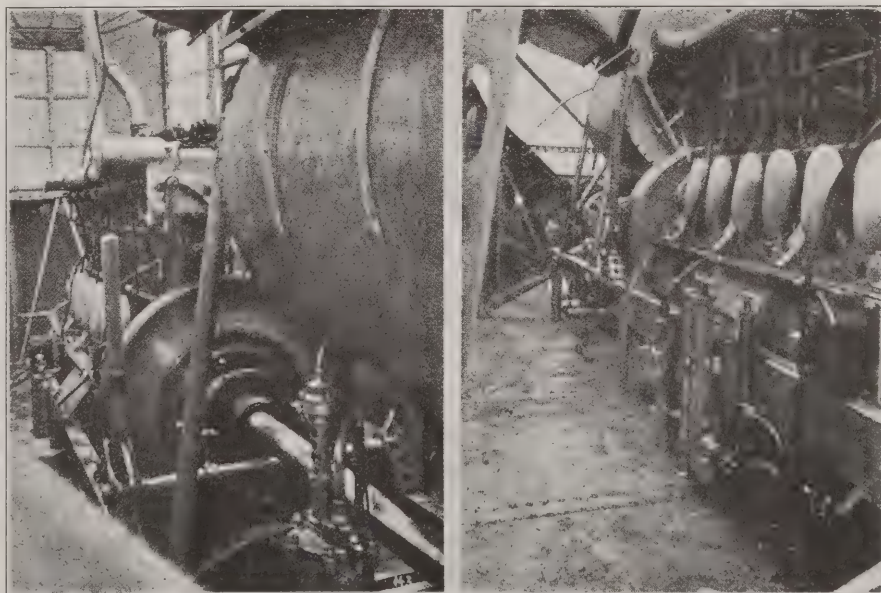
however, made for slinging another ten petrol tanks in the keel, bringing the petrol capacity up to 8,000 kilogs. (17,600 lbs., or about 2,500 gals.) if long journeys are contemplated. The list available for paying load is then, of course, correspondingly decreased. In fact, by the time one had counted in a crew of about ten, with their provisions, there would be little more load available.

As regards the placing of the petrol tanks in the keel, they are arranged in three groups, corresponding to the arrangement of the engine cars. The forward group, feeding the front engine, consists of six main tanks and one gravity tank. A similar number and arrangement feed the aft car, while the central group, which supplies the two wing engines, consists of fourteen main and two gravity tanks. All the tanks are arranged for easy slipping in case of emergency.

The arrangement of the cars will be understood from a reference to the accompanying photograph of the airship in flight. The control car is

placed right forward. A short distance aft of this is the forward engine car, under the keel of the airship. Approximately half-way along the length of the ship are the two wing engine cars, some distance out from the center line, and finally near the rear end of the keel is the aft engine car. Each of the engine cars contains one 240 h.p. Maybach engine, driving pusher screws through reduction gearing and clutches. The engines are mounted with their crankshafts about 10 ins. above the floor of the car, and the lower part of the crank-case can be reached by removing a loose floor plate. The transmission includes a reverse, two wheels being in mesh for forward and three for reverse. The reduction is such that, although the engines run at 1,400 r.p.m. at full power, the propellers run at 180 r.p.m. only. Their diameter is 14 ft. 9 ins. A blower, or fan, placed in the stern of the car, is driven at a speed of 1,850 r.p.m., by means of a silent chain, and delivers $2\frac{1}{2}$ cubic meters (88 cubic ft.) of air per sec., at 100 mm. of water. The engine cars have a length of 6 meters (19 ft. 8 ins.), a maximum width of 1.8 meters (5 ft. 11 ins.), and a height of 1.6 meters (5 ft. 3 ins.).

The control car is 9 meters (29 ft. 6 ins.) long, 2 meters wide (6 ft. 7 ins.), and 2 meters high. It is divided into three compartments, of which the forward one is the control cabin, and the aft one the wireless compartment. From the central compartment access to the keel is gained via an automatically closing trap door, and a shaft leads through the hull to a platform on the top of the envelope. In the control cabin the rudder control wheel is placed forward and slightly over towards the starboard side. The elevator control



Views inside the port engine car. On the left, the engine, clutch, and air compressor; on the right, close-up view of the engine and blower

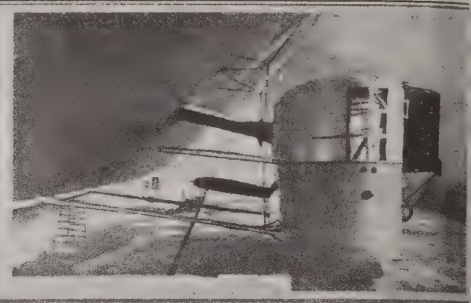
wheel is placed on the port side. The control cabin is, of course, provided with a number of instruments, as well as with the controls for gas and air valves, etc.

The hull or envelope of the "PL-27" is made of three-ply fabric, of which the inner and outer layers run longitudinally, while the middle layer is placed at an angle of 45 degrees. The tearing strength of the fabric is stated to be 2,000 kilogs. (4,499 lbs.) per meter width. In addition to this strong fabric, the hull is strengthened by so-called trajectory bands. These are bands of webbing, about 2 ins. wide, stuck to the envelope fabric and covered with water-tight cover strips. The use of these bands constitutes, we believe, a *Luftfahrzeug-Gesellschaft* Patent. The tearing strength of these bands is 1,320 lbs.

The gas space is divided by three fabric bulkheads, into four compartments, of which the forward and aft have a capacity of 6,260 cubic meters (220,500 cubic ft.) each, while the other two have a capacity of 9,390 cubic meters (331,500 cubic ft.) each. The fabric bulkheads are reinforced with webbing and are capable of carrying a difference in pressure between their two sides. If, for any reason, it should be necessary to equalize the pressure in two adjoining gas compartments, this can be accomplished by a hose which is normally kept closed by being tied up, but which can be opened by the crew.

Each gas compartment is provided with an air bag or ballonet, which when completely filled occupies 52 per cent. of the gas compartment volume. Thus, the capacity of the fore and aft ballonets is 3,250 cubic metres (115,000 cubic ft.) each, and that of the second and third ballonets 5,000 cubic metres (176,500 cubic ft.) The ballonets consist of two portions, the lower of which, attached to the envelope, is made from two-ply fabric, of a tearing strength of 1,200 kilogs. per metre width, while the upper part is in a single thickness and has a strength of 900 kilogs. (2,000 lbs.) per metre width.

Each of the gas compartments is provided with two gas valves, placed in shafts and discharging through the top of the envelope. The openings on the top of the envelope are covered with fabric hoods. Each ballonet has two air valves, built into the keel, and having discharge pipes leading into the open. In addition, each ballonet has an inlet valve of the flap type, serving to admit air from the fans. The four flap valves communicate with a common pipe or hose, into which all four blowers discharge. Each ballonet has also a pressure regulator (automatic) which ensures that there is always an excess of pressure of 25 mm. of water. Should the



Two views of the port engine car. On the right can be seen the struts which brace the car to the keel structure

pressure fall to 23 mm., the regulator opens the inlet valve, which communicates with the common pipe from the blowers and keeps it open until the old pressure has been established, when the valve is closed. If the pressure rises to 27 mm., the pressure regulator opens either the air valves of the ballonet or the gas valves of the gas compartment, or both, according to the setting of the switches in the control car. The actual operation of pulling the air or gas valve cords is carried out by the automatic regulator, although when required, as, for instance, in landing, members of the crew can operate the valves direct, without the action of the regulator.

The tail planes are so attached by struts, etc., that they cannot be pressed into the envelope. They are designed for interchangeability, the fins and tail planes being identical. The elevators are, however, different in shape and size from the rudders.

Altogether, the Parseval "PL27" is a very interesting airship, and it has proved that it is possible to design even quite a large ship without necessitating a change over to rigid construction. It is confidently expected by the *Luftfahrzeug-Gesellschaft* that, if desired, even larger ships can be built on this principle, but even taking the "PL27" as she existed in 1916, the type should have a considerable sphere of usefulness at the present time, and the type has the advantage of having been tried out to the satisfaction of the designers, behaving well during maneuvering, and showing a good turn of speed. It may be expected that when Germany is once more free to develop, without the present restrictions, more will be heard of airships of this type, and we should not be surprised to hear of regular services being established between Berlin and London, which cities are sufficiently far apart to afford a considerable saving in time by traveling by air, and yet not so far as to necessitate the use of rigid airships.

Reserve Officers Receive Instruction at Mitchel Field

Twelve reserve officers reported at Mitchel Field, L. I., New York, in a

body on Saturday, May 13th, for flying and for instruction in installation of radio equipment on aeroplanes. Major Harrison H. C. Richards, Air Service, on duty with the Reserve, was in charge of the party. All of these officers were given flights, which took up largely refresher flying instruction and practice landings. To date, no reserve officer who reported at this station with proper credentials authorizing participation in aerial flights, has been refused an aeroplane.

The Army pilots charged with the duty of giving this refresher instruction to the many reserve officers reporting at Mitchel Field report that these officers get back into shape very rapidly.

The Air Service Mechanics' School

At the present time there are 55 students undergoing the various courses of instruction at the Air Service Mechanics' School at Chanute Field, Rantoul, Ill. This leaves an approximate number of 110 men awaiting instruction. These men will be entered within six weeks. The entrance of this number of men will exhaust the last of the men enlisted in the recruiting drive some six months ago. There are now sixteen courses of instruction in active operation.

Photographic Missions Completed

Lieutenants Robert E. Self and Wm. C. Goldsborough, have completed their seven thousand mile photographic mission, having photographed all available landing fields in Northern California and Nevada. They landed at Crissy Field while the Flying Circus was in full blast, and were heartily greeted by their flying "Buddies."

On Friday, May 26th, Captains W. A. Bevan and R. G. Irwin and Lieutenants J. P. Richter and C. R. Weber landed at Crissey Field, after completing their mission of photographing the landing fields of Southern California and Nevada. An 18,000 ft. high sandstorm was encountered by them on their flight across Death Valley, which, it is believed, is the reason for the copper tipping on their propellers being so shiny.

The Handasyde Type H.2 Monoplane

THE FUSELAGE

The fuselage—which is apparently the least novel part of the machine—appears to be of the normal three-ply covered type now so widely in use. Actually it has a number of novel features, and is not quite so commonplace as it might at first appear. It is really of the braced longeron and strut type, the bracing being performed by the ply wood skin. The “struts” are in the form of hoops, which also act as formers.

This fuselage is built in two parts, the forward one an engine-carrying nose, and the after part, which contains cabin, etc., and carries the tail. The main fuselage body is built on

four longerons—each one of which is in three straight lengths. The forward length, of spruce, covers the space occupied by the pilot's cockpit. Over this space the longerons diverge rapidly in side elevation from front to rear. There follows a second straight length, corresponding to the passenger cabin, which is also of spruce. Over this space the four longerons are parallel. From the rear of the cabin to the tail longerons are of ash. The top longerons over this section slope down very slightly towards the tail, the lower longerons sweep up very considerably.

Joints between these longeron sections are of the simple fishplate type,

and are covered by three-ply skin—so that the main body of the fuselage is not a dismountable structure.

The front frame of the forward section consists of four spruce members, with three-ply cornerpieces. There is an intermediate set of four spruce struts and thereafter follows the hoop structure of the cabin.

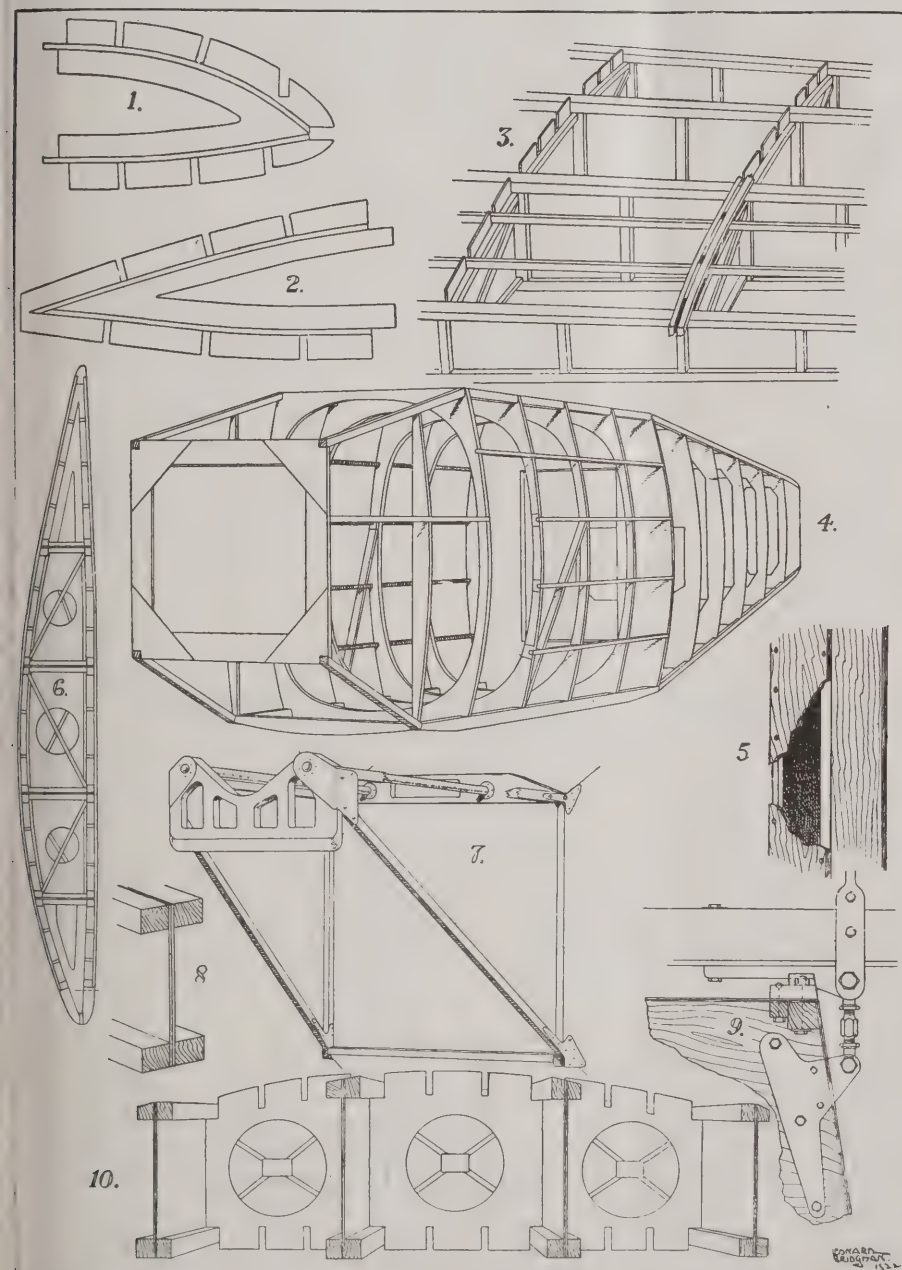
The hoops—which are in effect the fuselage struts, in this cabin portion—are of box section. The inner member of each box is a bent hoop made of ash in two plies. The outer members are of spruce, and the sides of the box are formed by three-ply. The whole structures are glued and screwed together.

The after “hoop” at the cabin end has the three-ply sides of the box extended inwards, and a door-frame worked into the structure, thus partitioning the cabin from a mail compartment which is immediately aft of it.

Aft of the cabin, the struts are built up of spruce only, but are in general of the same type of shape as the cabin hoops. The first beyond the cabin is three-ply covered to form the bulkhead of the goods space, but is fitted with a sliding door so that one may crawl into the after part of the fuselage for inspection. At the rear end of the body there is another solid bulkhead just forward of the front spar of the tail plane.

Over and above the four main longerons there are numerous stringers of spruce from the front of the cabin to the tail. In the cabin length these stringers are continuous, except for the necessary stoppage at the door, which is arranged between the first two of the cabin frames. They are let into the outer spruce members of the hoops. Over the after part these stringers are stopped at each frame, and serve only to support the outer skin. The skin of three-ply is screwed to all frames, longerons, and stringers. Joints in the three-ply are made by butting the two sheets, applying a “fishplate” of three-ply about 4 inches wide on the inside only, and riveting through from skin to “fishplate” with hollow rivets of about 3/16 diameter pitched about 3 inches apart.

The general appearance of a fuselage framework uncovered is shown in one sketch. A succeeding sketch shows the engine-carrying nose which is attached to the main body. This nose consists of two ash members on each side, which meet at a forward cross member of five-ply spruce. The engine bearer tubes run from the front cross member to the upper cross member of the bulkhead in front of the pilot. This nose does not form a



Details of the Handasyde Monoplane.—(1) the nose and (2) the tail of one rib former. (3) Part of the main wing structure, showing the four main spars and two ribs. The left hand rib is without capping strips. The through stringers are in place between the two nearest spars, and the capping strips are in place over the first section of the right-hand rib. (4) The skeleton of a fuselage seen from the front. (5) Section of one of the fuselage main hoops, showing construction. (6) Elevation of a complete rib (compare figs. 1, 2, 3, 4). (7) The nose of the fuselage. (8) Diagram of wing spar structure. (9) Attachment of a wing spar to the fuselage. (10) End view of a wing root, showing spars and four sections of wing spar to the fuselage.

detachable engine mounting, because the after support for the engine bearer is part of the main fuselage structure. The nose is however removable after taking out engine and bearers, and this appreciably simplifies packing up the machine for transport.

WING STRUCTURE

The structure of the wings is the most interesting part of this machine. The machine is of the cantilever monoplane type, with the wing entirely above the fuselage. The whole conception of these wings is unusual. They are of the multi-spar type, with a wooden covering, and apart from the joints between the wings and the body, the two halves of the wings, and aileron hinges and control mechanism the only metal parts employed are screws.

The wings are heavily tapered, both in plan and in section, from root to tip. The leading edge sweeps back slightly, the trailing-edge very pronouncedly. The section is an unusual one. The top surface is of the usual type, with its maximum camber in the region of $1/3$ the chord from the leading edge. The lower surface is practically flat over the spars, but slopes down sharply from the leading edge to the front spar, and somewhat less sharply up from the rear spar to the trailing edge. The section therefore is biconvex. The four spars, which are spaced at approximately equal intervals across the chord, are all of the H section built up, with top and bottom flanges of spruce in two halves, and a web of spruce two-ply, which web is covered with glued on fabric. The flanges are glued and screwed to the webs.

The ribs are formed of three-ply built in sections which fit into the recesses in the spars. They are stiffened with spruce members glued and screwed to them, roughly parallel to the wing surfaces, but considerably inside those surfaces. The outer edges of these rib webs are notched between spars, the through-going spruce longerons are run through the notches. There are two of these stringers between each spar. Over the stringers is applied a set of continuous spruce laths, which form the rib flanges proper. These are screwed to each spar and stringer. The covering consists of strips of spruce, corrugated internally, which are laid on parallel to and flush with the rib flanges, and are also screwed to each stringer and spar. This spruce skin serves the purpose of drag bracing, and also as the top and bottom flanges of the composite girder formed by the whole structure. The leading edge and the trailing edge are formed by three-ply formers similar to those between spars, which are supported by the through rib flanges. These are also provided with longitudinal stringers running right through. The leading edge proper is formed of three-ply bent to trough section, screwed to the leading stringers, which are of extra heavy section. The trailing edge is of solid spruce.

The details of this very novel wing structure are well shown in some of the accompanying sketches.

The wings are built in two sections, which join on the centre line of the machine. Owing to the fact that except in the case of the front spar, all spars meet at an angle, it has required

form of joint. A sketch shows how some ingenuity to obtain a simple joint the difficulty has been overcome.

The wings rest on the top rail of the fuselage over the cabin. An aluminum block is fitted beneath each spar and this block carries at its outer end a downward projection which registers on the outside of a mating block of the same material on the longeron. This block on the longeron is fitted with two upwardly projecting tongues, one of which registers on each side of the block on the spar. Therefore when each set of the blocks is properly engaged, the wing is accurately located both laterally and longitudinally in reference to the fuselage.

The lift load from the spar is taken to the main fuselage structure through one right- and left-hand screw adjuster—generally of the nature of the ordinary wire strainer, which is coupled at the top to a strap surrounding the spar and at its bottom to a lug attached to one of the main fuselage frames.

From this description and from the sketches it will be realized that this machine has many features of great novelty and interest. The type of construction is necessarily somewhat expensive at the outset, but as soon as the necessary jigs are set up repetition should be extremely cheap. The absence of complicated metal fitting allows the machine to be built by any competent staff of woodworkers, and if in fact the type proves to be free from trouble due to warping of the timber, it may prove to be a serious rival to metal structures in the future.

The Aeroplane.

A New Czecho-Slovak Commercial Biplane

IN the first commercial aeroplane to be designed and constructed in Czecho-Slovakia this re-born country has demonstrated that, in spite of the fact that up to a few years ago its aviation industry was conspicuous for its absence, it is already capable of taking its place amongst the foremost aircraft constructing nations. This new commercial machine has just been turned out from the works of the Aero Aircraft Factory of Prague, whose designers, MM. Husník and Vlasák, are to be congratulated in having produced a machine the general lines of which at once strike one as being both practical and pleasing to the eye.

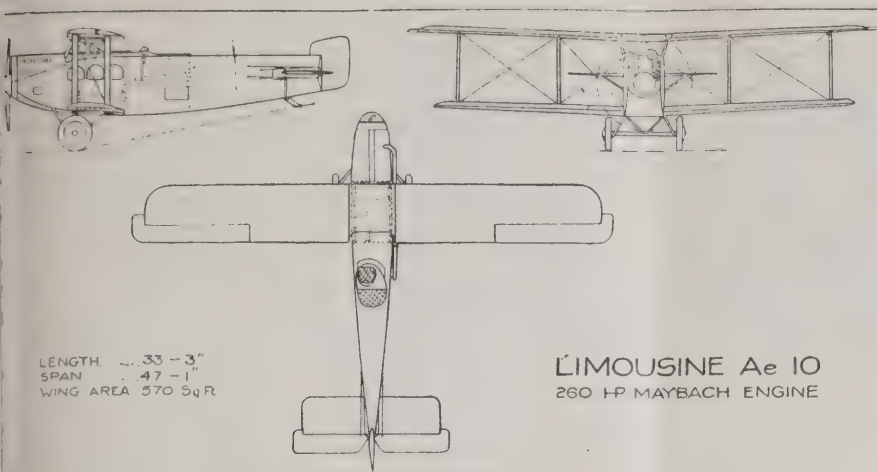
The Limousine Ae 10 was designed to meet the needs of the growing demand for aerial intercourse with neighboring countries, the Republic being determined to take an active part in the various aerial services running, and to be run, to and from Czecho-Slovakia. It is a tractor bi-

plane, with a deep fuselage of good streamline form. The engine, a 260 h.p. Maybach Mb. IVa, is mounted in the nose and drives a 10 ft. 3 in. tractor screw. The radiator is mounted behind the latter, and has been found to give very satisfactory results, causing little resistance.

Behind the engine is an enclosed cabin accommodating three or five passengers, and separated from the engine compartment by a double metal-covered partition as a precaution against fire. The cabin is very roomy, well upholstered, and has double walls, ceiling and flooring, giving an exceedingly strong construction; it is also isolated and noise-proof, and so adds to the safety and comfort of the passengers. Three windows, glazed with Triplex, on each side of the cabin give a good range of vision, whilst the rear window may be used as a direct communication between the cabin and the pilot—conversationally, of course.

Access to the cabin is by means of a door on the right-hand side of the cabin. In the cabin are three comfortable seats, and two tables which are upholstered underneath, so that they can be tilted up and used as seats when two extra passengers are carried. At the rear of the cabin is space for luggage, measuring 5 ft. in, by 3 ft. by 2 ft. Above this is the pilot's cockpit, just behind the main planes, from which an excellent view in all directions is obtained. Provision is also made for the accommodation of a navigator, who has a seat just behind the pilot, and both can easily change places if desired. A fire extinguisher, in direct communication with the engine and carburetor, is also located in this cockpit.

The main planes are in five sections: the lower in two attached direct to the fuselage, and two upper attached to a small center section. They are set at a dihedral angle, but no sweep back, and the top plane has a ver-



light overhang. Balanced *aileron*s are fitted to the top plane only. The main petrol tank is carried in the top section, whence the petrol is led by gravity through a single pipe, *via* filter, direct to the carburetor. The control system is thus of the simplest form possible. The tank is filled by means of a special pump, and the petrol passes through a filter before entering the tank.

The tail planes are of tubular steel construction, fabric covered, and consist of an adjustable rectangular horizontal stabilizer, mounted between the

upper and lower *longerons* just above the line of thrust, two balanced elevators hinged to the stabilizer, and a balanced rudder. No vertical fin is fitted, as the flat sides of the *fuselage*, which tapers to a deep vertical knife-edge, renders this unnecessary. The controls are of the conventional type—elevator and *aileron* column, and rudder bar.

Special attention has been given to the undercarriage, as it was realized that many of the accidents are caused by faulty landing gear. The two wheels are of large diameter—960

mm.—with the object of enabling the machine to land on very soft and uneven ground. They are located well forward, which has the effect of giving a quick pull up. The wheels are mounted on a divided axle, with rubber shock absorbers, which is carried by twelve steel struts, having six points of attachment to the *fuselage*. These struts are arranged in three pairs of “M’s, when viewed from the front, as indicated in the accompanying general arrangement drawings. Landing shocks are thus well distributed over the *fuselage*; in places the factor of safety is about 12, both in the landing chassis and cabin. Throughout the machine double wiring is employed.

The principal characteristics of the Limousine Ae-10 are:

Span	47 ft. 1 in.
Chord	5 ft. 9 in.
Length	33 ft. 3 in.
Height	11 ft. 8 in.
Area of main planes...	570 sq. ft.
Useful load (3 pass.)...	1,650 lbs.
Weight, fully laden...	1,620 lbs.
Weight/sq. ft.	8.2 lbs.
Weight/h.p.	17.7 lbs.
Speed	93 m.h.p.
Duration	4 hours
Engine.....	260 h.p. Raybach

—Flight.

Weather Forecasts

in its desire to have its forecasts, warnings, and information made of the greatest possible benefit to aviation and aviation interests, the United States Weather Bureau has arranged a plan of cooperation with the Chief of Air Service, U. S. Army, by which it is hoped closer contact may be established between its aviators and Weather Bureau officials in the field.

The plans of this cooperation have been announced by the Chief of Air Service to all commanding officers of Air Service fields in a letter which describes the arrangement.

In this letter the Weather Bureau requests that, in order that the personnel of the Army Air Service and the Weather Bureau may become personally acquainted and by so doing be able to discuss the possibilities and limitations of their respective services, the pilots at the various Air Service fields in their regular training fly to the various Weather Bureau stations shown on the Weather Bureau map which are within a radius of 300 miles from such fields, become acquainted with the personnel at such stations, discuss the problems of the two services, and arrange a system of cooperation. The prevailing weather conditions of the particular section of the

country involved should be discussed as bearing upon the work of the Air Service. On these trips the pilots should make notes of the terrain flown over and the landing facilities en route and at the destination.

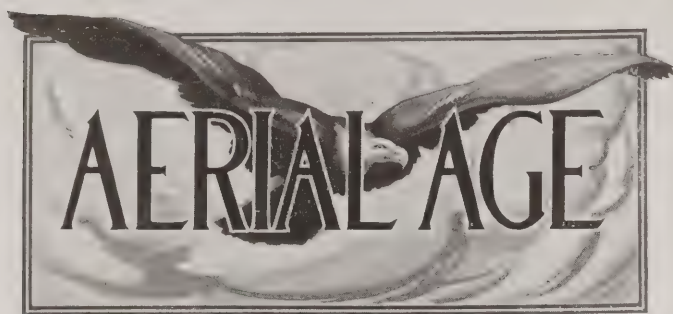
The Weather Bureau deems it advisable that lectures on the general work of that Bureau, the weather conditions of the particular country where Air Service fields are located, and meteorological subjects pertinent to aviation should be delivered to the Air Service personnel, and the Chief of the Weather Bureau invites applications from Air Service Fields with the purpose in view of making arrangements for the delivery of such lectures.

Aviation forecasts for the six aviation forecast zones of the United States covering the country east of the Mississippi River are broadcasted by Radio from the Naval Radio Station at Arlington at 10:30 a. m. (5950 CW) and at 10:00 p. m. (2650 CW). The Weather Bureau requests that arrangements be made to have radio operators on duty at Air Service stations within these zones receive these forecasts. The night forecast will cover weather conditions in the zone until noon of the following day,

whereas the morning forecast will cover weather conditions from noon until midnight.

The *Washington Post* and the *Washington Herald* publish each morning a special forecast furnished them by the Weather Bureau for routes from Washington, D. C., to Norfolk, Va., and from Washington, D. C., to New York City, and arrangements will soon be made for a similar forecast for the route from Washington, D. C. to Dayton, Ohio.

Request for information on weather conditions from Air Service fields, whether made by telegraph or telephone, are to be without expense to the Weather Bureau; but any aviator of the Army who has made a landing at a point not near an Air Service field is permitted to send a prepaid telegram to a Weather Bureau office for the purpose of obtaining the latest forecasts and information as to prevailing or conditions. Weather Bureau officials receiving such messages are instructed to reply promptly, giving the best possible information in answer thereto and transfer same to the sender at the expense of the Weather Bureau, such reply messages to be checked “Paid WEA.”



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Shall Britannia Rule the Air?

A PROGRAM of development of aviation which would give to Great Britain as complete a domination of the air as was her domination of the sea prior to the world war is now under consideration and apparently likely of adoption as a definite permanent policy of the British government. Dispatches from London report that the British press is flooded with aviation propaganda preparing the people for huge government expenditures necessary to float an air fleet, subsidize private commercial lines, aid plane and motor manufacturers, continue experimentation, and train and maintain pilots, observers, and mechanics.

That is a natural development of the British character and of Britain's many years of experience in the government of an empire stretching around the world. The British government and people have long realized that only through the maintenance of the world's greatest navy could they have full assurance that the lines of communication and trade between the widely separated parts of the empire would be kept open and maintained in any emergency. A dominant navy meant life of the empire.

The rapid rise of the United States as a sea power in the closing years of the world war brought Britain face to face with the necessity of sacrificing this position. The American program threatened to outbuild Britain. The economic condition of Britain was such that it could hardly hope to compete. At the same time lessons of the war and experiments in the sinking of battleships by aeroplanes which followed the war cast considerable doubt upon the ultimate value of battleships as opposed to aeroplanes. There was no certain conclusion that a \$40,000,000 battleship would be helpless before a \$10,000 aeroplane, but there was a doubt.

The odds were too great to bet against. That, probably as much as anything, was a leading factor in the Washington decision for the limitation of capital ships. But that did not change the British belief in the necessity of remaining dominant among the nations if possible. The great aviation program outlined is a direct result of that conviction. It shows the way for America.

Our dominions extend from the Philippines to the Virgin islands, and from Alaska to Porto Rico. Our responsibilities extend even further—definitely to the tip of South America. We must be in a position to defend and maintain this territory and these responsibilities. If England has, through its envoys, accepted the 5-5-3 naval agreement only with the intention of stopping development on the sea to begin it in the air, our program should be clear before us.

Every British aeroplane should be matched by an

American aeroplane. Every British dirigible should be matched by an American dirigible. Every British hangar and landing field and supply station and experimental station should be matched by its equivalent in American territory. Every British expert in the development or operation of flying machines and in aerial warfare or commerce should be matched by an American as good, or better. And then we should have a few extra.

We do not expect to have war with Britain. In fact we intend not to have war. But in any emergency which may arise we should be competent to emerge the victor. We have voluntarily given up what would have been a campaign of superiority on the sea. Thereby we have saved hundreds of millions of dollars without additional risk. But that risk comes if we submit to a position of inferiority in the air. No premium is too great to pay for insurance against such risk.—*Editorial in Chicago Tribune.*

Army Air Service Promotion

THE death during the flight of two officers of the Army air service—those of Captain Thomas H. Shea, Jr., and Lieutenant R. E. O'Hanly—has again called attention to a situation in that branch that is in dire need of correction. Such casualties are of so frequent occurrence as to sustain a record of eight per cent of flying officers who are killed every year. Vacancies created in this way are not filled by the promotion of air service officers, but by transfer to the air service of officers of other branches of the Army. The air service is unfortunate in the position on the promotion list of its junior officers, who, because of their long period of training during the war, not only find themselves segregated near the bottom of the single list. Their seniors are in many cases younger in age, and only longer in service by a few weeks or months, in a circumstance that determines relative place on the promotion list, by virtue of the fact that the average period of training in other arms was about three months compared with the air service training period of about nine months. The result has been that not only has the commissioning of air service officers been delayed, but whereas officers of other arms had an opportunity of being initially commissioned in grades as high as field officers, the air service officers were limited to being commissioned in the grade of second lieutenant, with few exceptions. Furthermore, there was lack of promotion in the air service during the war, because it was a new corps. When the single list was compiled after the appointments of July 1, 1920, it was found that practically all of the officers, who were originally commissioned in the air service as flying officers, held the bottom files of the promotion list. That left vacancies in the grades of captain particularly, and these were filled, and are being filled, by officers transferred from other arms, who have had no war experience in air service activities and who are in many instances junior in age. The air service has a total of 900 officers, of whom over 700 are officers commissioned subsequent to April 6, 1920, and of this 700 about 500 are original flyers whose commissions were delayed, so that 200 of them are officers who were transferred from other arms or who came in as ground officers and are ranking the junior officers of the air service. The latest returns of the adjutant general's office show 608 first lieutenants in the air service, while in the infantry, which should have approximately three times as many as the air service, there are but 1,008. The reason for this is that the majority of young officers in other arms, instead of being first lieutenants, are captains.

The situation in the air service in respect to promotion has been the subject of consideration by the special

(Concluded on page 426)

THE NEWS of THE MONTH

Navy Gets \$6,537,000 to Build New Aircraft

Washington.—Inclusion of a Senate amendment of \$6,537,000 in the naval appropriation bill for new construction of aircraft was agreed to June 21 by House and Senate conferees on the annual supply measure. It was the first meeting of the conference.

While the committees were discussing the appropriation measure Senator Pomerene (Dem., Ohio) announced in the Senate he had been informed that Admiral Wilson, Superintendent of the Naval Academy, had notified thirty civilian instructors there that their services were to be dispensed with.

The appropriation bill, as it passed the Senate, carried a provision for reducing the number of civilian instructors from the present 118 to 80 and Mr. Pomerene condemned the reported action of Admiral Wilson as presaging further attempt to get rid of the civilian instructors.

New York Flyers Forming Own Unit

New York is to have a flying unit all its own. There has been at Hempstead a temporary aviation squadron, but these men were part of the 102d Infantry, and when the unit is recruited will be transferred back to the 14th Infantry. Recruiting for the unit, which will be known as the 27th Air Service, has been started and a group of New York men who brought down many enemy aviators during the war have signed.

Among these are Major Kenneth Littauer, who was a member of the Lafayette Escadrille; Capt. G. De Forest Lerner, who brought down eight enemy aeroplanes; Capt. Curtis Wheeler, who has six citations; Capt. George A. Vaughan, Jr., who has a record of thirteen enemy machines, the D. S. C. and British, French and Belgian medals; First Lieut. Howard Burdick, who brought down eight enemy planes, and nine other officers who did valiant service in Europe.

General Order No. 16, sent out from the State Adjutant General's office, authorizes the reorganization of the air service for the State Guard. It orders change of station to Miller Field, New Dorp, Staten Island, and allocates the seaplane hangar in the southeast corner of the 300 acres at the armory for the 27th.

Capt. G. L. Usher, U. S. A., is designated as the Regular Army air instructor for the National Guard. Capt. Usher already is in residence at Miller Field. The total strength will be 31 officers and 160 men, including a photograph staff of twenty and five intelligence men.

Tarkio, Mo., Flying Meet

The merchants and business men of Tarkio, Mo., are promoting an aero meet at Tarkio, July 27-8-9, inviting all flyers to compete in events, paying all expenses, such as gas, oil, hotel expenses and entertainment, and giving many cash prizes and cups and trophies. C. E. Tuttle is employed to manage the meet.

Tarkio is the home of Tarkio College, a town of about 3,000 population and very much alive.

The field selected for the meet is an 80-acre blue grass field one and a half miles south of town, with plenty of emergency fields adjoining.

The Larsen Trophy

The Contest Committee of the Aero Club of America on June 30th directed C. B. Wrightsman, of Tulsa, Oklahoma, to return to the Aero Club of Omaha, \$3,000 in prize money, which it is alleged, was wrongfully awarded to him following the Larsen efficiency aeroplane contest, held in Omaha last November. This step, it was learned, is the first in the adjustment of a situation which has been the subject of discussion in American aeronautics for many months. John M. Larsen, donor of the trophy, whose entries in the race established undis-

puted performance, notwithstanding which the officials made the award to Wrightsman, has presented evidence supporting his claim that a fraud was perpetrated. Wrightsman is ordered to return the money within 10 days or be disqualified. Upon return of the prize money, further hearings will be held.

Spokane News

Captain Lowell Smith, one of the army air service's best known pilots and holder of several American air records, landed in Spokane at the municipal field at Parkwater on June 22 in a 400-horsepower De Havilland-Liberty motored plane. He is accompanied by Sergeant Whitefield.

Captain Smith is flying over the west, mapping all municipal and other landing fields for use of the government army flyers. He made the best time in the transcontinental air race two years ago, fighting a close contest with Captain Belvin Maynard, the "flying parson."

On his present trip out of headquarters at San Francisco, Captain Smith and his sergeant have photographed landing fields in California, Wyoming, Nevada, Utah, Boise, Montana and are now completing their map-making work in Washington.

They left next morning for the Coast, stopping en route to take field photos at Walla Walla, Yakima, Pasco, and other central Washington points.

He has covered 6000 miles since leaving California. Captain Smith and Sergeant Whitefield have been assigned to the photographic work by the air service.



The Bellanca Model C. F. Monoplane which made an excellent showing at the Monmouth Flying Meet

On an aerial tour from Buffalo, N. Y., to Siberia, C. O. Prest, aviator, landed in Spokane on June 21. He is making what he claims is the first transcontinental aerial travelogue moving picture ever taken and expects to cover over 8500 miles on his trip.

Prest carries a moving picture camera especially mounted so he can use it while operating the plane, and two ordinary cameras for still pictures. He took several hundred feet of film of scenes along the Spokane river in Spokane.

Aviator Prest has been flying since 1910, having flown first in the old Bleriot monoplane and the old-time Curtiss machines. A month ago he started on his cross-country trip. Before coming to Spokane he took aerial views in and around Glacier park.

La Porte Carnival

The Cleveland Air Transit Company is planning to hold an air carnival at La Porte, Indiana, on August 15 and 16.

Cincinnati News

Cincinnati will have no municipal airport for at least another year, is the announcement made today by C. W. Culkins, executive secretary of the Cincinnati Chamber of Commerce, due to the fact that the Government will not establish a reserve squadron station here and contribute the greater part of the finances. Mr. Culkins made the announcement after a statement to this effect had been received from Senator Frank B. Willis.

Regardless of the fact that there is no field at Cincinnati available for landing, the Cincinnati Aircraft Company is making rapid progress, and during the past week has made several sales, using a field near Harrison, Ohio, for its facilities. A small fac-

tory has been established at Second and Sycamore streets, where rebuilding and repair work is being carried on on a small scale. It is understood that this company will secure the services of Mr. D. W. Huntington, aeronautical engineer of Hempstead, N. Y., with a view to building a transportation ship. Negotiations are being carried on between the officers of the company and Mr. Huntington to this end, it was stated by Secretary M. H. Held, of the company.

Mr. H. F. Woolard has been appointed representative of the Cincinnati Aircraft Company for Indiana, with headquarters at Indianapolis.

New Aerological Survey Issued by Weather Bureau

Of special value to aviators is a section dealing with free-air winds, contained in a discussion of free-air conditions of pressure, temperature, humidity, density, and wind, as observed by means of kites, issued as Supplement No. 20 of the Monthly Weather Review by the Weather Bureau, United States Department of Agriculture.

The winds have been classified according to wind direction at the surface, and the average amount and frequency of veering and backing with altitude, increase in speed, percentage frequency of each direction, of north and west components, and of speeds above 10 and 20 meters per second have been determined and are presented in tabular and graphic form.

Many tables and figures are given in the supplement, and also a series of charts valuable to meteorological students. The marked difference between summer and winter conditions in the free air, as at the surface, though in less degree in the former is well brought out in these charts.

It is a significant fact that the average direction and rate of movement of storms across the country are very nearly the same as the average wind direction and speed at heights of 3 to 5 kilometers. Measurements have been taken by kites up to 5 kilometers, or 3 miles.

This publication, which is available to interested persons upon application to the Weather Bureau, is Part I of an aerological survey, which will later include the diurnal variation at different heights, the results of observations with pilot balloons, and similar information.

Kansas City Activities

Plans for an airdrome which will make Kansas City a leader in aeronautical activities were announced on June 18, by the Flying Club. A 53 acre field, which will be leased to the government and operated under supervision of air service officers is being purchased by Major Howard F. Wehrle, Rogers Crittenden, Frederick H. Harvey, Robert E. Lester and Simpson Yeomans.

The site which has been approved by Major Ira A. Rader, of Fort Crook, Neb., corps area air officer, and Capt. St. Clair Street, a member of the National Airways board, is on the Davenport road a few hundred feet south of Blue Ridge boulevard on the way to Rayton.

Plans for the development of the field are tentative, include:

Eight hangars, arranged about the rectangular field, two garages, and a machine shop, motor car parking space, a grand stand with a capacity planned at five thousand, space for a clubhouse for the flying club, space for an aviation school, where civilian fliers may be trained. This would be a privately owned concession.

Quarters for the civilian flying school, barracks and similar enterprises, and a field marker in the center of the field with "K. C." lettered in colors on a white background.

The field will be used by the government and civilian aircraft. It will be used by the government for army operations and training purposes. Principally for the training of reserve officers. Also the air mail will be accommodated at this field in addition to the establishment of the national guard aviation squadrons at this place.

Boston is the only city which has taken advantage of the government plan of leasing privately purchased ground for an airdrome, so far. Other cities which have similar plans are San Francisco, Chicago, New York, Los Angeles and Minneapolis, it is reported.

Major Wehrle who was active in securing the field, is particularly well equipped to direct successfully a project of this kind.



Pilot Chas. Pedley and Mrs. Pedley, who are doing good work in the Southwest and West

He superintended the laying out of Hazelhurst field, Mineola, New York, the first government school in the East and the second in the United States. He was one of the early aviators who took training with the Curtiss company in 1916. When the war broke out, he was a Captain in the air service, and was immediately assigned to the task of preparing plans suitable for aviation fields. His plans were copied by various fields about the country.

According to the plans of the five men, an Air Terminal association will be established and incorporated with 40,000. Stock will be sold, and facilities on the field will be provided for by the corporation. Five hundred square feet of ground on the terminal field will be let to the flying club for the building of a clubhouse. In addition the club will carry on their activities on this field free of rent or charge. The old American Legion field at Sixty-seventh street and Belinder road will be abandoned as soon as the lease expires on November 1, 1922. A new hangar there which is nearing completion will be moved to the new field, according to plans of the flying club. Also all other facilities will be transferred to the new field or other points. There are now twelve ships on the present field, all actively engaged in flying. Much of the flying is done in passenger carrying and training of pilots.

Following the announcement of the plans for the terminal, Mayor Frank Cromwell voiced approval of the new enterprise and urged the early developments, that Kansas City might get ahead as rapidly as possible.

"It is not only a matter for those who are directly interested in flying to think about," the Mayor said, "but is a civic matter and will be a distinct asset to Kansas City."

At present the final details and purchase of the field depends on Washington. As soon as the lease is signed by the government, work on the hangars and the field will commence. It is said that the new airdrome will be completed by the first of the coming year.

The Air Service plans to send ten planes and a detachment of six men, one officer and five enlisted men, who will supervise activities.

At a meeting of the flying club in the hotel Baltimore, June 22, evening, after three hours' debate, the club decided to indorse the project and accept the plans of the terminal association. At first much opposition to the plan was voiced by Francis Poinster and a committee of four men. They argued that should the club accept the proposal of the association, Kansas City's aerial activities would fall entirely into the hands of five

men, that the club would lose its prestige and would no longer be the city's leading faction in the promotion of flying.

Several squadrons of reserve officers of the air service are established in the vicinity of Kansas City and with these organizations eager for active participation in flying along with civilian flying much activity is apparent for Kansas City. Two manufacturing concerns are considering branch factories here in addition to three air lines which are proposed from Kansas City to Chicago, from Kansas City to Oklahoma City and from Kansas City to St. Louis. The main sales office of the Huff Deland aero corporation is established here, and plans are on foot to move the factory from Ogdensburg, N. Y. to Kansas City. Also the Longren Aircraft of Topeka, and the Laird Swallow company of Wichita are now preparing plans for active work in Kansas City. The Laird Swallow company is establishing a regularly operated air line between Kansas City and Wichita which will be in operation as soon as two large planes for the purpose are completed.

Petitions for the establishment of an air mail terminal are also under advisement. The association hopes to bring this service through Kansas City before the year expires. Two new flying schools are in preparation, and in addition to passenger work, much of Kansas City's advertising in the nearby states is carried on by aeroplane. The Victor Oil company here have two planes which are used to carry their salesmen about the country.

Spokane News

Co-operation of local aircraft companies, centralization of activities and a comparatively small amount of money spent on the Parkwater municipal field will give Spokane aviation facilities second to none, Captain Lowell H. Smith, famous army flyer, said while in Spokane recently.

In his big De Havilland plane, driven by a 400-horsepower motor, he left Spokane, circled the field, the city and Fort George Wright, while taking aerial photographs, and then soared away to the west, headed for Yakima.

In the interests of the Army air service Captain Smith and his aide are making a 6,000-mile trip over the West, mapping the principal landing fields. He will take back pictures of 75 fields when he reaches headquarters at the Presidio, near San Francisco.

"Parkwater Field is the best I have seen since leaving Cheyenne; Wyo., which is on the Government aerial mail route," Captain Smith said. "It



The Dirigible Mooring Tower at Lakehurst, New Jersey

is large enough for a four-way field and one of the best in the country. The city or somebody should devise some means of clearing parts of the field of rocks which now dot the surface and which might cause someone to damage a ship.

"Your aerial activity at Spokane should be centralized. All flyers here should co-operate to make the business a success and should all put their ships at the one field. With all flying from one field, there would always be someone ready to go into the air and far better results would be obtained."

Captain Smith says Spokane has one of the few fields in the West suitable for teaching beginners flying work. Its size, he said, affords beginners far greater safety.

The Commercial Club at Walla Walla, Wash., obtained an indefinite lease on a tract of land one mile east of the city for use as an aviation field. The land is owned by Eugene Tausick and the Baker Langdon Company and can be leveled at little cost. The owners agreed to let the club use the land without cost. Several automobile dealers have agreed to furnish tractors to help level the ground. This is the first step in a movement to put Walla Walla on the aerial route. The field will be available to any aviator who happens to be traveling through and will be suitably marked so that it can be plainly seen from the air.

Air Mail Performance

At 12 o'clock Sunday night, July 16, the Air Mail Service of the Post Office Department completed a year's daily service without a single fatal accident. During this time the planes flying on the New York to San Francisco route covered 1,750,000 miles. More than 49,000,000 letters, totaling 1,224,500 pounds, were transported.

The record of the Air Mail Service for the past year proves more conclusively than any other test ever made the reliability and the efficiency of the aeroplane in commercial service. Through every kind of weather, summer, fall, winter and spring, and over mountains, deserts and forests, the Post Office Department air mail planes flew. The percentage of trips actually completed was 92.5 per cent, as compared with 83 per cent for the last fiscal year. The percentage of scheduled miles actually flown was even higher, totaling 94 per cent.

While routes totaling 820 miles were discontinued during the last fiscal year and only the transcontinental route of 2,680 miles maintained, the Air Mail Service nevertheless carried the same amount of mail as it did last year, or 23 per cent more in each aeroplane load.

Officials of the Air Mail Service attribute the record of no fatal accidents in a year to the fact that all their pilots now are experienced and tried and they know the route. That the pilots of the Air Mail planes of the Post Office Department are top-notch among the flyers of the United States was established at a recent Midwestern flying meet at Monmouth, Ill. Here the flyers of the Air Mail Service took five events of the eight and six cups of the nine given as prizes. The mechanics, too, are more experienced. Last year was a pioneer year. Then the pilots were learning the routes they were flying and the field and hangar equipment was inadequate. During the fiscal year ending June 30, 1921, seventeen people died in accidents in the Air Mail Service. Many of the fatalities occurred with the metal monoplanes which were abandoned. During the last fiscal year one pilot was killed. His death occurred on July 16, 1921, but no man has met death in the Government Air Mail Service since then. In the last year no flyer has been in the hospital more than five days.

The Air Mail Service is now maintaining sixteen stations on the ocean-to-ocean route. Fifty-six planes are ready to fly. In addition, some are being overhauled and some are in storage waiting to be assembled. The Air Mail Service is employing forty of the most expert pilots in the United

States. The total number of men employed to fly the planes and to keep them in repair is 372. Every day twenty-one pilots and planes are in the air, flying approximately 6,000 miles. The speed possible by the use of the Air Mail is shown by the fact that mail sent from New York has been delivered in San Francisco three days later.

The Post Office Department expects to establish night aerial mail service on the transcontinental route within this fiscal year. At present the planes are used chiefly to advance mail delivered too late to catch trains on which earlier mail left, but night flying planes will carry mail from New York to Chicago or from Chicago to Cheyenne.

(Concluded from page 401)

a definite plan. For months there had been under consideration a flying meet and congress, but definite action was not practicable until the last fortnight, when a representative of the Chicago Aeronautical Bureau called on us. The plan is to hold a flying meet and convention, August 4 to 13, to which no admission will be charged. The purpose is to develop Chicago's position in air transportation. The president of the Chamber and others, including Messrs. Curtiss and Redden, have accepted invitations to speak. The meet, as presented to us, has our hearty approval and it is recommended that the Chamber sanction it and otherwise assist it in every way possible.

Aeronautical Institute: There has been under consideration the desirability of an Aeronautical Institute. It now appears that at the time of the Pulitzer Races in Detroit the program of the Detroit Aviation Society includes the organization of an Air Congress in connection with the effort that is being made to perfect the National Aeronautic Association. In the replies that we have received to our questionnaire on this subject there is considerable divergence of opinion on this subject. This, in a measure, is due to a misunderstanding of aims, scope and purposes of such a plan. Many of our members assumed that an Air Institute would be limited to consideration of engineering problems and consequently recommended that the work be left entirely to the S. A. E. As a matter of fact, a program for an Aeronautical Institute would not only include papers on engineering subjects, but consideration of questions of aerial law, national and international policies, insurance, military and naval use of aircraft, organization of aerial transportation

companies, both as to personnel and finance, etc., etc.

Co-operation with Local Chambers of Commerce

As we are increasing our contact with local Chambers of Commerce we receive increasing demands from these organizations for co-operation. They are gradually forming the habit of not only referring to us the peculiar questions of their locality regarding landing fields and the establishment of air lines, but the inquiries that they receive from individuals of aeronautical questions.

Sales Information

We have an increasing number of requests for information regarding sources of supply for aeronautical material, which is regarded as a very wholesome sign, not only as indicating the manner in which our organization is being used, but the increasing interest on the part of the public in aeronautical development.

President Harding's Letter

Following is the letter, mentioned above, which the Aeronautical Chamber of Commerce received from President Harding:

"The White House,
Washington.

"Gentlemen:—

"I find pleasure in adding a word expressive of my interest in aerial transport, and in the presentation of the subject which is being made by the Aeronautical Chamber of Commerce. The history of civilization is largely the history of communication. Each stage of progress seems to demand and develop improved means of transport. The steamship, the railroad and the motor car have been devised and utilized. Now we enter a new phase. It is a real distinction to America to be known as the birthplace of the aeroplane; it should be our concern that this art shall not languish, but that in its practical application we shall lead the world. An amazing development will take place in the near future in the utilization of the air as a medium of transport and communication. As a government we are aiming to provide this art with necessary guaranties of law, and with such facilities as may be possible through the encouragement of air ways and terminals. But for air transport quickly to achieve the important place it is destined to occupy it must have public interest and support. I hope your efforts in this behalf may be productive of most gratifying results.

"Very truly yours,

"WARREN G. HARDING.

"Aeronautical Chamber of Commerce of America, Inc., 501 Fifth Avenue, New York City."

THE AIRCRAFT TRADE REVIEW

New York-Atlantic City Service

Passenger accommodations to fill a six-place flying boat daily from Atlantic City to New York have been booked for one month in advance, the Aeronautical Chamber of Commerce announced in connection with the regular daily service each way by Bomarine Airways. Their flying cruisers will leave the municipal flying station at Eighty-second street, North River, every afternoon at four o'clock. The flying boats will leave the Curtiss Airport at Atlantic City ten o'clock in the morning for New York. The trip between the cities is made entirely over the water. It will require only 75 minutes, as against three and a half hours by train.

B-G Expansion

Owing to the fact that the demand for B-G spark plugs has increased so tremendously the company has had to take larger office and factory space at 15 West Fifty-second street, New York.

Navy Department Test of Wright Engine

The Navy Department has had a quiet way of doing a considerable amount of development work on aircraft engines during the past two years. An interesting evidence of this is the recent completion of test of 250 hours on a Wright E-2 engine. This engine was run for two periods of 125 hours each. One hundred and twenty-five hour runs were continuous, twenty-four hours a day, the only stops being three in each period due to gasoline shut off, trouble with oil radiator leakage, spark plug renewal and the necessity for carburetor renewal, as part of the test was conducted in a rainy period.

This engine was run at the rated horsepower of 180, and a rated speed of 1800 r.p.m. on straight aviation gasoline. While the results of the test are not for publication as yet, it is understood that the Navy Department is well pleased with the tremendous durability shown by the engine and it is also understood that the Wright Company intends to incorporate in future production engines several modifications of the standard E-2 which were tried out during this test. Representatives of the Wright Corporation who observed the test are enthusiastic about the way the men of the Bureau of

Aeronautics on duty at the Naval Air Station at Anacostia, D. C., handled the running of this very arduous bit of research work. One of the most interesting points in connection with this endurance test is that the connecting rod bearings, which were the weakest point in the original type "A," 125 H. P. Hispano engines, from which the present engine was developed, ran for the full 250 hours and showed no measurable wear in that period; also that the valves which were regarded as being very delicate in the early engines were in such a condition at the end of the test that they would have undoubtedly run another full period of 125 hours.

Flying School Data Wanted

The Aeronautical Chamber of Commerce are preparing data on flying school activities during the past year, and all schools are requested to send the approximate number of pupils turned out during the past 12 months, with photographs of activities where practicable.

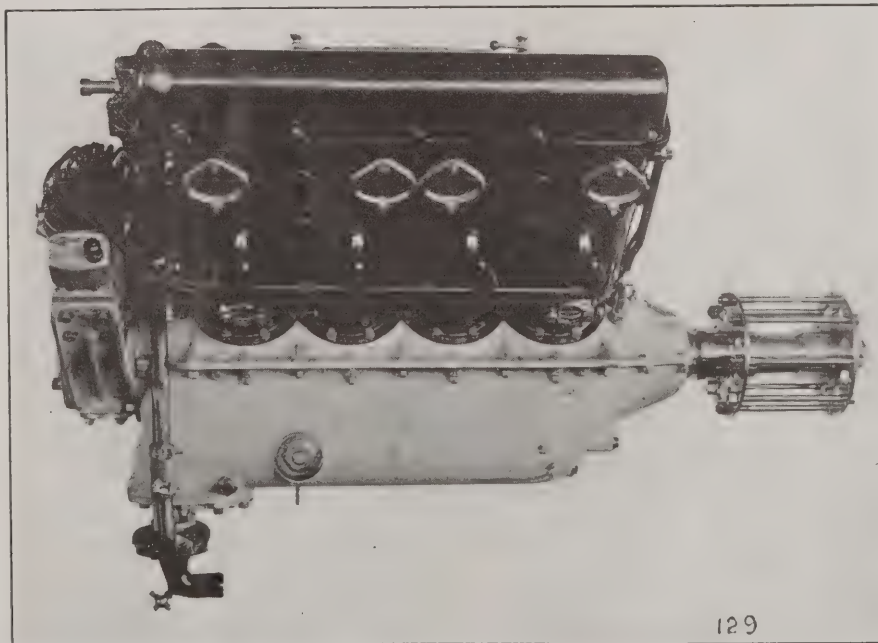
Photographic Opportunity

The Aeronautical Chamber of Commerce has received a communication from Mr. Theodore G. Holcombe, Secretary of the Committee on Post Office and Postal Facilities, of the Boston Chamber of Commerce, 177 Milk Street, Boston, Massachusetts, requesting information relative

to the cost, etc. of an aerial survey of Boston. He desires, for his files, the names, etc. of reliable firms engaged in aerial photography, that they may be available in case an aerial survey is decided upon.

Standard Atmosphere

Report No. 147 of the National Advisory Committee for Aeronautics, by Willis Ray Gregg, discusses the need of a standard set of values of pressure, temperature and density at various altitudes and points out the desirability of adopting such values as are most in accord with actual average conditions, in order that corrections in individual cases may be as small as possible. To meet this need, so far as the United States is concerned, all free-air observations obtained by means of kites and balloons at several stations in this country near latitude 40° N. have been used, and average values of pressure, temperature and density, based upon those observations, have been determined for summer, winter and the year and for all altitudes up to 20,000 meters (65,000 feet). These values are presented in tables and graphs in both metric and English units; and in the tables of densities there are also included values of density for other parts of the world—more particularly for Europe. A comparison with these values shows that, except in the lowest levels, the agreement is very satisfactory. A further comparison with



The Wright E-2 Engine, a product of the Wright Aeronautical Corporation

values of density determined from Toussaint's law of temperature decrease, $t = 15 - .0065z$, in which t is the temperature in $^{\circ}\text{C}$ and z the altitude in meters, indicates very good agreement with those values up to 10 kilometers. It is therefore recommended that the United States adopt Toussaint's values of density up to 10 kilometers and the values presented in the tables for all higher altitudes.

A copy of Report No. 147 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Triangle Airways

The Triangle Airways of Chicago operated their two six-passenger flying boats from Chicago to Michigan City on July 4, to transport fans to the Leonard-Rocky Kansas bout. Short flights are made regularly by the company from the old Columbia Yacht Club.

The Slotted Wing

We are in receipt of the following letter from C. A. Wragg, aeronautical engineer, Washington:

In the article on the "Theory of the Slotted Wing" by A. Betz, Göttingen, printed in your issue of June 26th, reference is made to the type of wing system (Fig. 5) in which a wing section is set close behind and below another to make a compound aerofoil unit for normal flight. It is stated that the flow about the forward wing is improved by the proximity of the rear one, but that the effect of the forward wing on the flow about the rear one is such as to detract from the advantage gained.

The writer pointed out this improvement on a forward section in such a wing system years ago, and also stated that not only could the destructive effect on the rear wing be minimized sufficiently to make the arrangement worth while as a fixed non-adjustable system, but that the airflow about a rear section set close behind and below can be affected in such a way as to augment the efficiency of each section and result in improved efficiency of the compound. He claims to be the first to point this out and has for many years advocated and endeavored to instigate a thorough investigation of this Compound Aerofoil.

Qualitative data obtained by the writer indicate that not only can the L/D be improved by embodying the requirements which he specified, but that this can be in a measure affected by reduction of drag at the low angles and values of lift used for maximum speed.

The system can therefore be ideally adapted for high speed, and by mak-

ing certain simple mechanical adjustments it can be changed during flight to considerably increase the lift coefficient by reducing or closing the gap (the reverse operation of the Lachmann and Handley Page idea) for the purpose of landing and rising.

Aeromarine Airways Opens Great Lakes Division

The Aeromarine Airways, Inc., officially opened a daily flying boat service between Detroit and Cleveland with the arrival of two eleven-passenger, closed-cabin flying boats, the *Santa Maria* and the *Wolverine*, in Cleveland after a 90-minute flight from Detroit on July 14.

On board the *Wolverine*, which was piloted by E. D. Musick, were C. F. Redden, president of the Aeromarine Airways, Inc.; W. E. Metzger, president of the Detroit Athletic Club; Commodore A. A. Schontz, president of the D. & C. Steamship Company; P. J. Reid, managing editor of the *Detroit Free Press*; H. V. Wilcox, of the *Detroit News*, and Roland Rohlfs, Detroit manager of the Aeromarine Airways, Inc.

On board of the *Santa Maria*, which was piloted by D. G. Richardson, were I. M. Upperque, president of the New York Cadillac Motor Car Company, and owner and president of the Aeromarine Plane & Motor Company, the parent corporation; C. F. Ketterling, vice-president of the General Motors Company; Dr. J. W. Inchee, Commissioner of Police of Detroit; Carl Fritchie, of Detroit; Frank Lewis, of New York; T. Norris, motion picture photographer; C. S. Mott, general manager of the General Motors Company, and a representative of the *Detroit Journal*.

The boats arrived at Cleveland at 12:20 p. m. The distinguished passengers were greeted by a committee from the Cleveland Chamber of Commerce. Glenn L. Martin, of the Glenn L. Martin Aircraft Corporation, headed the welcoming delegation. H. A. Bruno, sales and advertising manager of the Aeromarine Airways Company, and Walter Hempel, field representative of the company, were also at the dock when the boats arrived.

The visitors and welcoming committee were driven in Cadillac automobiles from the dock to the Cleveland Chamber of Commerce. The procession was escorted by a troupe of mounted police. At the Chamber of Commerce they were met by Mayor Fred Kohler, and Newton D. Baker, president of the Chamber of Commerce, gave an address of welcome and complimented Mr. Upperque and Mr. Redden on the initiative shown by the Aeromarine company in developing commercial aviation in America.

The party returned to the flying boats at 3 o'clock p. m. and at 3:20 p. m. the boats left the water on the return flight to Detroit, arriving there at 4:41 p. m.

The Cleveland station of the Aeromarine Airways, Inc., is at the D. & C. dock at the foot of East 9th street. Tickets and reservations may be made at this station and also at the uptown office of the D. & C. company, 201 East 9th street.

In Detroit the operating base is at the Memorial Park and the river. The downtown passenger station is at the foot of First street. Tickets may also be had at the D. & C. offices. The operating equipment for this service is up-to-date in every way. Fast motor boats and base floats were shipped from the Aeromarine factories at Keyport, N. J., and are stationed at the different bases. Through the cooperation of Commodore Schontz, Aeromarine passengers have the use of the D. & C. waiting rooms at both cities. The boat schedules are as follows:

Leaves at 9 a. m. from Cleveland and Detroit. Returns at 5 p. m. from each city. The fleet consists of the *Santa Maria*, the *Wolverine*, and a six-seat open boat, the *Niagara*. Another eleven-passenger flying cruiser has been ordered from the factory and will join the fleet within a few days. This boat was named the *Buckeye*.

Air Mail Radio Service

Plans are being considered by the Post Office Department for changing at least a few of the fifteen radio stations operated in connection with the Air Mail Service to provide both radio telegraph and radio telephone service. The stations are at Washington, D. C.; Hazelhurst, L. I.; Bellefont, Pa.; Cleveland, O.; Bryan, O.; Chicago; Iowa City, Ia.; Omaha, Neb.; North Clark, Neb.; Cheyenne, Wyo.; Rock Springs, Wyo.; Salt Lake City, Nev.; Reno, Nev., and San Francisco.

The Washington station has had both radio telegraph and radio telephone service for nine months. Besides maintaining an hour-to-hour record of the progress of air mail, the Post Office Department radio station now send out other information. Complete weather reports now go out daily. Also reports of grain, dairy and livestock prices travel the ether waves to the farms and farming communities.

It is still uncertain just when the stations will be changed to radio telephone apparatus. Because of the first call on the radio by the Air Mail the equipping will probably be gradual. Further announcements concerning the new service are expected within a short time.

ARMY *and* NAVY AERONAUTICS

Navy Prepares for Detroit Races

The Navy is making extensive preparations for the forthcoming aerial contests to be held in Detroit in October and it is hoped and confidently expected that the Pulitzer Trophy and the Curtiss Marine Flying Trophy will fall a prize to Navy contestants.

In the Pulitzer Race, the Navy will make five entries, among which will be the Curtiss Navy Racer CR-1, winner of the event in 1921. This plane holds the world's record for a closed circuit. The CR-2, another entry, is a modification and improvement over the CR-1, and will undoubtedly be heard from. Two Booth Racers, BR-1, supplied by the Aerial Engineering Corporation, have a designed speed of 216 miles per hour. One MB-7 (Thomas-Morse Monoplane) of tried and proven ability and having exceptional qualities of manoeuvrability will be entered, and stands an excellent chance of winning the race.

In the Curtiss Marine Trophy Race, the Navy will have ten and possibly eleven contestants, which include two FRs, two TSs, and two Curtiss Triplanes, 18T type. Other entries in the Curtiss Race will be an HA Fighter, a Gallaudet D-4, an H-16, and a VE-9.

Intensive training of pilots is projected for the summer in preparation for the contests. They will be sent to Detroit in September and there continue training and familiarize themselves with the course.

The Detroit Races were originally scheduled for September, but recent advices from The Detroit Aviation Society postponed the dates of the Curtiss Race to October 7th and of the Pulitzer Race to October 12th.

The Baby Bomber

The air flivver has arrived. It is driven by a 17 horsepower motor taken from a popularly known motorcycle, which its builder used to ride.

This little plane was constructed at McCook Field by O. H. Snyder, one of the aeroplane experts. It is 16 feet in length and has a wing spread of 11 feet. It weighs less than 400 pounds and is the smallest thing that flies at McCook Field, where it is affectionately called the "Baby Bomber."

Lieutenant John A. MacReady, who holds the world's record for al-

titude, 42,800 feet, recently put the Baby Bomber through her paces in a two-hour flight. She did everything that a regulation plane can do. On a straightaway flight she made 62 miles an hour, was then throttled down to 21 miles an hour in landing and came to a dead stop in 40 feet. In taking the air she requires a runway of from 150 to 200 feet.

MacReady declares the little flier rides easy, is well proportioned and evenly balanced.

Snyder superintended the construction of the baby and built nearly all of it himself. Consumption of oil and gas is no greater than that required to send a motorcycle down the pike at 45 miles an hour.

Snyder believes that his little machines can be developed commercially and fill a need which is manifesting itself in aviation.

A Chain of Air Routes Across the United States

The latest project of the Airways Section, Office Chief of Air Service, is the formulation of a plan for the thorough investigation of practically 90 per cent of the proposed Airway System of the United States. Letters of instructions have already been sent out to the various Army Air Service flying fields, designating certain routes over which pilots from those fields should fly. Upon the completion of the initial investigation of the routes tentatively selected, and after a decision is reached as to the most advisable routes to fly over, the Army Air Service contemplates making ar-

rangements for the inauguration of a regular bi-weekly aeroplane patrol over these routes, to enable pilots of the various fields to ascertain from time to time the condition of landing field facilities in the district allotted to them.

Pilots will be required to promptly report any field previously selected which has since been plowed up or otherwise rendered unsuitable for landing.

The object of establishing a system of air routes across the continent is to enable the Army Air Service to plan cross-country flights of a special nature, such as maneuvers, etc.

The establishment of this trans-continental airway system should prove of material aid to commercial flying and stimulate long-distance flights. Flights across the United States will not be of such a rare occurrence as at present, and it is possible, in view of the great saving of time, such flights will become popular, since they will curtail a journey of at least five days by train to two days at the most.

Transfer of Photographic School

The transfer of the Photographic School from Langley Field to Chanute Field, Rantoul, Illinois, marks the removal of what may be considered as one of the landmarks of Langley Field. The original school was established here in the Summer of 1917, soon after the organization of the Photographic Division of the Signal Corps. British advisory officers in the persons of Major Campbell and



The Baby Bomber designed and constructed by O. H. Snyder at McCook Field

Sgt. Major Haslett were among the first to arrive to teach the new use of photography from aircraft. These officers were also pioneers aerial photographers of the British Army.

At this time, Langley Field was just beginning to take form. The first Photographic School building was built by the students, many of them newly commissioned reserve officers. The personnel was at first quartered in what was known as the "old red barn," only the foundations of which may now be seen. The first class was graduated in the Fall of 1917, and some of the graduates were sent immediately overseas, others to flying fields and still others established schools of aerial photography at Post Field, Cornell University and Kodak Park, Rochester, N. Y. The latter was probably the largest school of photography ever operated, having had, at one time, as many as 800 students under instruction. The Cornell school a few months after its establishment, became the training center for photographic officers.

With the organization of other schools, the parent school became the school for aerial observers and continued as such until the Armistice. After the closing of the schools at Rochester and Cornell, the Air Service Photographic School, as it is now constituted, was re-established at Langley Field in the Summer of 1919.

The photographic laboratories and facilities of the Photographic School are probably unsurpassed by any similar school. Since its establishment three years ago, upward of fifty officers and one hundred and fifty enlisted men have been graduated.

Mexican Officers Visit Kelly Field

General Covarrubias, of the Military College of San Jacinto, Mexico, with his staff, visited Kelly Field on May 16th and was highly pleased with the aerial demonstration given at the field and much impressed with the possibilities of bombardment and attack aircraft in use against rebels and bandits in his country. The 2nd Photo Section took a number of pictures of the General's party and they were developed, printed and dried, labelled and presented to the party before they left the field. Four formations of five planes each passed before the reviewing stand in honor of the visitors.

Admiral Fullam Praises Bombardment Pilots

The morale of the Bombardment Group at Kelly Field went up another peg following Rear Admiral Fullam's address in San Antonio recently on the "Possibilities of Aviation," in which he praised the unparalleled feats of the bombardment personnel in the battleship sinking business last

summer on the Atlantic coast and foretold some of the amazing possibilities of aerial bombardment. Of course, the members of the Group know all these things, but they like to hear others say them just the same.

Advanced Students at Kelly Field to Graduate

The present class of student officers and cadets has about finished their advanced bombardment training. There has been only one major crash during the present class. Cadet Halpin, on May 16th, attempted to make a forced landing in a small muddy field and wrecked the aeroplane. He escaped without serious injury.

Spraying New England Forest

Following previous experience in connection with the spraying of trees by aeroplane, plans have been formulated for spraying a section of the New England forest by this method. Captain R. A. Kinloch, Air Service, on duty with the 1st Squadron at Mitchell Field, L. I., New York, was detailed on this duty and departed for Boston, Mass. He investigated landing field facilities in the vicinity of the forest to be sprayed, and has been in consultation with the representative of the Department of Agriculture who was assigned to conduct the experiment.

Setting Up of Martin Bombers

The L. W. F. Engineering Corporation recently completed setting up and testing the first of the thirty-five Martin Bombers to apply on their contract for the Government. The first plane was flown by the test Pilot, Lieutenant Wade, of McCook Field to the Aero Marine Plant at Keyport, New Jersey, to be used as a model. Work is now in progress by the Curtiss Corporation in setting up at Mitchell Field the first of the Martin Bombers which that corporation is building for the Army. This plane is now practically ready for test. It is understood that the Curtiss Corporation will turn out one Bomber per week, all of these to be set up at Mitchell Field.

High Parachute Jump at Kelly Field

Master Sergeant Chester W. Kolinski, of the 90th Squadron, stationed at Kelly Field, San Antonio, Texas, made a successful parachute jump on May 24th from an altitude of 10,600 feet, so far the highest jump made by any member of the parachute school during the present course. The training pack chutes were used, and the ship was piloted by Lieutenant J. H. Doolittle. Both chutes functioned perfectly.

A Memorial at Love Field

At the entrance to Love Field, Dal-

las, Texas, there now stands a small granite monument, which was dedicated on May 30th last in memory of the twelve officers and cadets of the Army Air Service who made their last flight at that field. As Love Field is to be abandoned as a flying field and may soon lose its identity, this landmark was erected in their honor. The memorial bears the individual bronze name plates which formerly hung in the Officers' Club at that field.

The dedicatory services were very impressive, and hundreds of people were present to pay their silent respect to the memory of the departed flyers.

General William R. Smith, commander of the 36th Division and veteran of the World War, paid a high tribute to the memory of the men who gave their lives during America's hour of stress. He declared that the progress of the aeroplane in the last war has shown conclusively that this method of warfare will continue to grow in importance, and that in event of future wars a still greater part will be played by the plucky and fearless men of the air. "They are honored dead," he said. "What they did in their struggles to master the air will be felt immeasurably as time flies on. Those martyrs who staked their lives in preparing for their needed service overseas did not die in vain. We owe them all honor and credit." As he stepped from the raised platform, he swept his cap from his head, which was the signal for the planes sent from Kelly Field, Ellington Field, Post Field and Love Field to take the air and circle the field. The planes rose gracefully and passing over the memorial shaft in rapid succession showered wild flowers upon the granite slab.

Other speakers were Hermon Whisnant, who was an officer of the First Division and lost his leg in the Soissons campaign; Charles L. DeBow, chairman of the arrangements; Major Jed C. Adams, and Mrs. S. M. Fields, president of the Southern Memorial Society, who placed beautiful wreaths on the stone, with short impressive and touching remarks. Near the front of the shaft the emblem of the American Air Service was placed by the women of Love Field.

The officers and cadets whose name plates are on the monument are as follows: 1st Lieut. Rex Everett Field, 2nd Lieutenants Charles James Hyde Parker Pruce, John Maxwell Widenham, Arthur Anthony Sego, Jr., Ralph Phelps Collier, Robinson E. Bidwell and Cadets Victor Leon Dennis, John William Albert Insinger, Ralph Eldon Stall and James Forestor Dick.

This memorial was the idea of Lieutenant Marion G. Putnam and

as his personal contribution to the memory of these men, many of them having been his friends.

General Patrick Visits Chanute Field

General Mason M. Patrick, Chief Air Service, and his party, arrived Chanute Field by aeroplane from Milwaukee on Wednesday, May 31st. The officers comprising the party were Major H. A. Dargue, Major P. Van Nostrand, Major Wm. C. McChord, 1st Officer, 6th Corps Area; Capt. J. C. Ocker and Lieut. H. K. Ramey. General Patrick made a thorough inspection of the field and left on Friday, June 2nd. Major Van Nostrand remained at the field and accompanied Lieut. Frank M. Paul on a cross country trip to Iowa City, Iowa, and thence to Scott Field, Belleville, Ill. Lieut. R. R. Fox also made this trip, the purpose of which was to map an air route from Scott Field to Chanute Field and other points.

Aerial Ambulance

Under orders from the Department of War all flying fields in the United States are to be equipped with the new type of aero ambulance recently developed by the engineering division at Wilbur Wright Field, the largest aerial supply depot in the Army Air Service.

Ambulances are in various stages of construction at the present time and will be delivered to the fields as rapidly as they are finished.

The new type is known as the Curtiss J N 68. It is driven by a 180-horse power Hispano motor.

The litter carrier or stretcher compartment is located in the fuselage near the center. It is entered through a door in the side and extending across the top. It is connected with the physician's cockpit by means of two hatches. The pilot's cockpit is right in front.

The first model built has been successfully tested and given the official OK by the department.

Promoting the Establishment of Landing Fields

The trip recently made by Captain S. Clair Streett, Air Service, on duty in the Airways Section, Office Chief of Air Service, for the purpose of making a general survey of landing facilities in the Eastern and Middle West sections of the United States, was productive of excellent results and, it is believed, will ultimately result in the establishment of a network of landing fields in these sections of the country which will go a long way in not only extending the use of commercial aviation but also in increasing the element of safety in

flying.

In the various localities visited by Captain Streett the various commercial aeronautical concerns, as well as the municipal authorities, aero clubs, chambers of commerce, etc., were made acquainted with the efforts being made by the Army Air Service to encourage the growth of commercial aviation. Captain Streett states that at those places visited where commercial aviation concerns had been actively operating there prevailed a marked enthusiasm for aviation and a willingness to co-operate in any manner possible. It is his contention that it is the duty of every Army pilot to educate the public in the safe and sane usage of the aeroplane; with the fact that by its use one is enabled to cover long distances in a short space of time; that with the existence of adequate landing fields regular schedules of flight can be maintained without interruption, since with aviation equipment developed to its present degree of efficiency it is very seldom nowadays that it is found necessary to postpone flying on account of unfavorable weather conditions.

Aside from the primary purpose of the trip, that of boosting commercial aviation and securing all available information on landing field facilities, much useful data was obtained which will aid in the preparation of standard maps.

The itinerary of the trip was as follows: Moundsville, W. Va.; Columbus, Ohio; Dayton, Ohio; Indianapolis, Ind.; Louisville, Ky.; Camp Knox, Ky.; Kokomo, Ind.; Wabash, Ind.; Lafayette, Ind.; Rantoul, Ill.; Belleville, Ill.; St. Louis, Mo.; Fulton, Mo.; Kansas City, Mo.; Fort Leavenworth, Kan.; Lincoln, Neb.; Omaha, Neb.; Des Moines, Ia.; Cedar Rapids, Ia.; Iowa City, Ia.; Davenport, Ia.; Monmouth, Ill.; Chicago, Ill.; Milwaukee, Wis.; thence back to Dayton, Ohio; Toledo, Ohio; Camp Perry, Ohio; Cleveland, Ohio; Buffalo, N. Y.; Rochester, N. Y.; Syra-

cuse, N. Y.; Utica, N. Y.; Schenectady, N. Y.; Albany, N. Y.; Boston, Mass.; Hartford, Conn.; New York City; Baltimore, Md.; Washington, D. C.

Despite the fact that for five days during the trip between Dayton and Rochester rainy weather prevailed practically the whole time the plane was in the air, the whole trip was accomplished without incident. The plane used was a DH4B, which covered approximately 4,000 miles, the entire trip consuming five weeks.

Dr. S. M. Burka, of McCook Field, accompanied Captain Streett on the trip from Dayton to Omaha and return, while Lieutenant George W. Goddard was the passenger on the remainder of the journey back to Washington. Photographs were taken of all possible landing places whenever the weather permitted, and sketches were made of all fields visited.

Data was obtained from commercial aviation operating companies on their past operations and on their plans for the future. A number of cities visited either have adequate landing facilities or contemplate the immediate establishment of same, viz.: Louisville, Columbus, Kokomo, Wabash, St. Louis, Fulton, Kansas City, Lincoln, Omaha, Des Moines, Davenport, Monmouth, Chicago, Milwaukee, Buffalo, Rochester, Utica, Schenectady, Albany, Boston, Hartford and Baltimore. At the present time facilities are available at all of these cities where landings can be effected, and at every one of these cities the Chamber of Commerce and civic officials, as well as commercial aeronautical firms, invite Army and civilian pilots to use their facilities. Detailed information with regard to the landing facilities at the above-mentioned localities can be obtained from the Airways Section, Office Chief of Air Service, Washington, D. C.



U. S. Army Type Aerial Ambulance

REVIEW of WORLD AERONAUTICS

A British Cross-Channel Seaplane Service

An Air Ministry communiqué, issued on June 14th, makes a definite statement as to the cross-Channel seaplane undertaking which has for some time past been the subject of vague rumor. The scheme, which is to be operated by a company now in process of formation, probably with the title of "The British Marine Air Navigation Company," has been approved by the Air Ministry, and will be operated under the general terms of the subsidy scheme which was published in June, 1921.

Services are to be run by seaplane between Cherbourg and Southampton, and Le Havre and Southampton, the main object of the scheme being (a) to shorten the cross-Atlantic journey to London by picking up passengers at Cherbourg and bringing them to Southampton, and (b) to speed up the London-Paris service *via* Southampton and Le Havre by carrying passengers and mail by seaplane instead of by boat. Subsequently, it is proposed to operate a passenger and mail service between Southampton and the Channel Isles.

The services are to be carried out by aircraft designed and built by the Supermarine Aviation Works, Ltd., of Southampton. The scheme has the support of the London and South-Western Railway Company, who will actively co-operate in the matter of through bookings and railway connections, and the French railway companies concerned are to assist by providing suitable train connections for the through route to Paris.

The operating company will receive as subsidy 25 per cent of the gross earnings from passengers, goods and mail, plus a payment of £1 10s. per passenger and 1½d. per lb. of goods carried. These latter sums are half of the similar payments made on the London-Paris route.

This enterprise marks a very important step forward in the development of real commercial aviation, and everyone who is acquainted with the history of the Supermarine Aviation Works, Ltd., will hope that the venture will be as successful as it deserves to be, and will bring to them—as the constructors of the machine to be used—an adequate reward for their persistent faith in the value of marine aircraft for transport purposes.

French Aero Salon

December 15th next to January 2nd, 1923, is the date fixed for the next French Aero Salon—the eighth—to be held, as before, at the Grand Palais. The exact title has been changed to "Exposition Internationale de l'Aéronautique."

Italian Competition Entries

The results of the entries to the International Idro-Aviation Race of the Schneider Cup which closed on May 31st, according to the Italian National Aeronautical Federation, are as follows: *Italy*—5 machines—Two of the Macchi Firm, two of the Società Idrovolanti Alta Italia and one of the Pegua & Co. Among these three must be chosen. *France*—2 machines to be designated. *England*—2 machines to be designated.

The results of the entries for the Angelo Berardi Balloon Race are the following: *Italy*—8 balloons. *Belgium*—2 balloons.

The Berardi Balloon Race will take place June 4th in Milan.

The entries for the International Race for the Tyrranean Cup and Grand Prize of Italy have been deferred until June 30th, 1922.

S. B. A. C. Officers

Mr. C. R. Fairey, M. B. E. (Chairman of the Fairey Aviation Co., Ltd.), has been elected Chairman of the Society of British Aircraft Constructors for the year 1922-23. Capt. P. D. Acland (Vickers, Ltd.) has been elected Vice-Chairman. Sqdn.-Comdr. James Bird (Supermarine Aviation Works, Ltd.) Hon. Treasurer. Sir Henry White-Smith, C. B. E., retiring Chairman, who has been Chairman of the Society since its formation in 1919, becomes Past-Chairman.

Twenty-Nine Days vs. Eight Days by

The Postmaster-General states that air mail for Baghdad which was dispatched from London on May 18th reached Baghdad on May 26th. This was a particularly notable achievement, as the normal time occupied in transmission by the combined ordinary and air route is between 11 and 18 days, and by ordinary route all the time it is about 29 days.

Dutch Parcels Air-Post

The Postmaster-General announces that parcels addressed to any part of Holland may now be posted for conveyance from London to Rotterdam and Amsterdam by air and for express delivery by the Dutch Post Office. Parcels will be accepted at the Post Offices in London and in the larger provincial towns where air parcels for Paris and Brussels are already accepted. The scale of charges, inclusive of express delivery at the place of destination will be as follows: For parcels weighing up to 3 lb., 4s.; 3-7 lb., 7s. 6d.; 7-11 lb., 10s. 6d. On parcels addressed "Post Restante" the charges will be 6d. less.

There will be two dispatches by air each day. Parcels posted in London overnight, and, in the provinces, in time to be included in the night parcels mails to London, will normally be forwarded by air next morning and delivered in Rotterdam and Amsterdam the same evening, and in other parts of Holland by the second morning after posting. They should thus reach their destination two or three days earlier than if sent by the ordinary parcel service.

Another Polar Trip

Plans for Major Tryggve Gran's aerial plane flight across the North Pole from Spitzbergen are well under way. With his expedition he has been in Spitzbergen since May 29, and the company is now engaged in a survey of conditions in the neighborhood of Mourning Bay looking for the choice of a starting point.

With Major Gran are the relief pilot, Lieut. Richards, formerly of the British



The Gloucestershire Mars I with 450 H.P. Napier Lion and Capt. James, who piloted the machine recently in England at 210 miles per hour

oyal Air Force, who holds the record for the fastest flight from India to London; Thorlief Haug, a famous Norwegian skiing expert, and Jacob Tullin Thams, a navigator. They left Christiania May 20, without knowledge that Capt. Roald Amundson was then on his way to Nome to make ready for his projected flight across from Point Barrow, Alaska, in the opposite direction to that which they contemplate.

Aftenposten, the newspaper, is bearing the expense of the expedition, together with friends of Gran. Gran intentionally kept secret that he would try to cross the North Pole, to exclude competition.

Officially, the expedition's only determination is to find out whether aeroplanes can be useful to help seal hunters.

"Aeroplanes will quickly be able to find the seals' resting place and instruct hunting dogs by wireless," Gran said before leaving Norway.

Major Tryggve Gran is one of the great adventurers of Europe. He comes from a noble Norwegian family and has been flying for the past twelve years. He was one of the first aviators to loop the loop, and in 1914, when a Lieutenant in the Norwegian Navy, made the first aeroplane flight across the North Sea.

One incident of this flight illustrates vividly the strides that have been made in aviation in recent years. In 1914 there was no such thing as an inclinometer, and knowing that he must fly through fog, Gran hung a lead plummet on a string before him in his cockpit. He had need of it, too, for in the course of his flight, and in the midst of the heaviest sort of a fog, he found the plummet hanging clear outside the cockpit. He was flying upside down!

During the war Gran was a Major in the British Royal Force, commanding a bombing squadron in France. At the close of the war he became identified with the transatlantic projects, and went to Newfoundland as navigator of the Handley-Page Atlantic, commanded by Vice-Admiral Mark Kerr, which remained weatherbound at Harbor Grace while Lawker and Raynham adventured and failed, and while Alcock and Brown adventured and succeeded. The Atlantic was ready for her attempt when the N-C-E's got away from Trepassey to carry the American flag first across the sea by air.

Aviation is but one of the daring sports that Gran has espoused. Famous from childhood for his skill on skis, he went with Scott to the Antarctic in 1910 and was one of those who discovered the gallant explorer's body in 1912.

British Subsidy

In the course of a speech at the Annual Convention of the Independent Air Force, in London, Captain Guest, Secretary of State for Air, stated briefly what the subsidy arrangement did for British constructors as follows:

(1) a direct payment of £3 per head per passenger that they carry; (2) machines on a hire purchase system at a total cost of three-quarters of their value; (3) change of machines at the companies' will; (4) meteorological services free; (5) use of aerodromes and sheds at a nominal charge; (6) Wireless and communication facilities gratis; (7) lighting services for night-flying purposes; and (8) benefits of Inspection and Research.

New Type Seaplane

The London correspondent of the New York *Herald* states that an aeroplane that according to its inventors promises to revolutionize flying soon will be submitted to practical test, according to information in aviation circles here. It is said to be unlike anything ever constructed before and is really a ship with wings. The utmost secrecy is maintained as to the details of its construction but it is said to mark the beginning of an aerial navy.

The plane is so constructed that it will not only float in calm waters, but it is claimed will be able to ride the roughest seas with the same security as an Atlantic liner. It is claimed that it will be equally airworthy. The hull is long, light and slender, without bulkheads. The elasticity of the hull which will make this possible is the outcome of many years' scientific research. The new machine will be a vast improvement on the present type of amphibians.

The experimental machine carries but seven persons, but designs for larger ones have already been made. The aeroplane will carry four or six engines and will be capable of traveling 100 miles an hour. It will be equipped with fog horns, anchors and riding lights. When not in the air it can travel on the water and thus accompany a battle fleet under all conditions.

Machines designed chiefly for commercial service will be able to cross the Atlantic Ocean in less than forty-eight hours, it is claimed, carrying a heavy load.

New Dutch Company

The aeroplane manufacturing industry in the Netherlands is being extended by the establishment at Rotterdam of a new concern, to be known as the National Aircraft Manufacturing Co. (N. V. Nationale Vliegtuig Industrie). This enterprise is to be financed by Dutch capital exclusively and is to have a new factory built specially for aeroplane production.—*Commerce Reports*.

The Fokker Aeroplane Works at Veere, the Netherlands, are now executing an order for 10 "F. 111" passenger aeroplanes, each equipped with a 350 h. p. Rolls-Royce engine. These follow 4 similar machines already constructed and forwarded to Berlin as the equipment for a new aeroplane service between Königsberg and Moscow, which is being established by the Russo-German Navigation Co. It is announced in the Dutch press that the Soviet Government has already executed a mail carrying contract with the new company.

In the first three months of the current year, 18 flying machines valued at \$84,248 have been exported from the Netherlands, as compared with 7 machines valued at \$45,000 in the corresponding period of 1921. Of the 18 machines exported this year, 10 have gone to Russia, 2 to the Dutch East Indies and 4 to Germany, the destination of the other two not being known.—*Commerce Reports*.



The Vickers "Vulcan," with 350 H.P. Rolls Royce engine, to be used by the Instone Air Line on Trans-Channel Services

FOREIGN TECHNICAL DIGEST

The New Two-Seater Junkers Monoplane

The new two-seater Junkers monoplane is built to the designs of Dr. Junkers of Dessau. Owing to the activities of the Aeronautical Commission of Control—which prohibited the building of aircraft in Germany up to May 5th—the machine had to be built in another country. Experimental work on this particular type has occupied some 15 months, and has included tests to discover a satisfactory engine, experiments with wings arranged at the bottom of the fuselage as in previous Junkers' monoplanes, and finally with the present arrangement.

Like the previous Junkers, the machine is of all-metal structure, using the characteristic corrugated thin sheet duralumin covering. The wing, of thick section, built on multiple tubular spars, is of 11 metres span and is built in one piece. It is attached to the top of the fuselage, and its leading edge is cut out to accommodate the pilot's head—very much as in the case of the Fokker F.III type.

The wing is also recessed on its under surface to accommodate the petrol tank—which is fixed actually to the top of the fuselage behind the pilot, but is enclosed by the wing when this is in position.

Behind the pilot and under the wing is a passenger cabin, large enough to accommodate two passengers, with a side entrance on the starboard side.

The undercarriage consists of two axles, hinged to a sort of rudimentary keel below the breast of the fuselage, a pair of thrust tubes, lying behind the axle, but also approximately horizontal, and a nearly vertical telescopic strut, fitted with shock absorbers fixed to the axle ends and to the fuselage side.

The engine is one of the 50 h. p. 5 cylinder radial air-cooled Siemens Halske type, fitted to the nose of the fuselage, and very thoroughly cowled in. The direct driven air-screw carries on its boss a forward projecting cylindrical nose of some

length, which is meant to protect the engine from contact with the ground in case of the machine standing on its nose.

The machine is designed for high-speed special transport work—such as newspaper work of the type associated with the name of Mr. Cobham in this country. Normally with full tanks it carries one passenger and a fair amount of baggage. With reduced fuel or with little or no baggage two passengers may be carried.

No precise details of dimensions, weight, or performance are yet available, but it is hoped that these may be available shortly.

New Safety Devices for Aeroplanes

As we note from time to time improvements in construction tending towards greater safety in flying, the conviction is reached that the aeroplane has not yet emerged from its experimental stage and that, through the inventive genius of man, the aeroplane will eventually reach such a state of perfection as to eliminate any further cause on the part of the skeptical-minded to characterize flying as hazardous.

In England there have recently been introduced two new devices for the aeroplane, both of them having to do with landings, admittedly one of the most difficult features of the art of flying. One of these devices is a shock-absorbing type of under-carriage and the other is a self-sealing gasoline tank designed to withstand the stresses set up by gun fire and in crashing.

The first-named invention, the oleopneumatic under-carriage, which has been designed by A. V. Roe & Co., of London, England, manufacturers of the Avro "Viper," should prove of great value in reducing the risk of landing on bad ground, and should also be of value for early training and night flying purposes. The *Aeroplane*, London, gives the following description of this invention:

"This gear consists of two main under-carriage legs which are coupled at the base to the axle, the axle again being

hinged by two horizontal tubes to the base of two steel tube Vees situated in front of the front legs. The main legs carry a shock-absorbing device which consists of a combination of oil and rubber, and is so designed that about half the travel of the telescopic leg is taken on the oil before the rubber is picked up. The detail of the oil valve is "interdit." The rubber shock absorber is in the form of separate rings, so that no trouble is entailed in replacing any particular broken or frayed portion.

On the ground the weight of the machine is carried by a combination of oil and rubber, and as the machine takes off the oil plunger sinks to its lower limit of travel. On landing the oil takes the first shock, so that by the time the rubber comes into play there is sufficient oil beneath the plunger to prevent bouncing. Mr. Hinkley (pilot of the Avro "Viper" testing the undercarriage) by changing his usual faultless method of landing, has been demonstrating how this undercarriage defies even the most ham-handed of pilots by deliberately flattening out at various heights ranging up to 20 feet from the ground and then "pancaking," and also by landing at 80 m. p. h. with very little flattening out, but it seemed that a great amount of effort on his part could induce the machine to bounce. It pulls up in a remarkable short run, and owing to the wide track of the wheels (6 feet) it is possible to navigate on the ground at almost any sane speed.

From the demonstration, which one witnessed, it would seem that the Avro "Viper" so equipped could land and get out of the smallest and roughest of fields possible without any trouble. As a training machine it might tend to give new-fledged pilots too much confidence and make them careless when passing into less robust machines, but for fully trained pilots it would seem almost ideal and guard the machine against almost any type of cross-country flying accident."

The Crash-proof gasoline tank, also mentioned, styled the "Silvertown Anti-Self-Sealing Petrol Tank," which was awarded the first prize in the British Air Ministry competition, calling for fuel tanks that will withstand machine gun fire and crashes without leakage of contents, and which tanks were subjected to the most rigid and exacting tests, is described in the same publication as follows:

"The metal shell or tank proper consists of thin-gauge metal plate butt welded together and of such a form as to permit a large increase of capacity before bringing any tensile stresses to bear on the metal, with the result that the seams successfully



The New Two-Seater Junkers Monoplane

withstand the stresses set up by gun fire and in crashing. This end is achieved by bracing inwards each side of the complete tank.

"The patent detachable cover is made of high-grade rubber about a quarter of an inch thick, formed with an opening large enough to permit of the introduction of the shell. This opening is then closed with a closure piece of the same material suitably fastened in place, and it is claimed that this detachability renders the cover superior to any previous device. The cover can be manufactured and stored apart from the metal shell, and the latter can be removed from its cover and replaced at any

time, without in any way causing damage to either.

"The judges appointed by the Air Council consider that the competition has resulted in the achievement of the objects for which it was instituted, and has produced a type of safety fuel tank which, although capable of improvement in several minor respects, is available for immediate introduction on Service and Civil aircraft, and which, for a slight increase of weight over and above that of the standard Service steel tank, gives almost complete immunity from fire, either in a crash or in action with enemy machines."

A New Low-Power German Radial Air-Cooled Aero Engine

LIMITED as Germany is to the use of engines not exceeding 60 h.p. for single-seater civilian airplanes, there is little doubt that in the next two years, after which time the position is to be reconsidered, we will see considerable progress made in the efficiency of German aircraft. The conditions imposed will force Germany, if she wishes to fly at all, to make such improvements in her aircraft as will enable it to do the work required with the limited power permitted. Thus, the restrictions may very easily turn out ultimately to be blessings in disguise. While other nations continue, in the main, to rely on power and more power, for increase in performance, load carrying, or whatever purpose the particular design is being used for, Germany is prevented from taking this short cut, and will, of necessity, have to effect the necessary improvements by more efficient structural and aerodynamical design.

Whether in anticipation of a limit of 60 h.p. for single-seaters we can say, but the fact remains that, just about the time when the latest

regulations came into force (May 5) the Siemens-Halske firm, of Siemensstadt, near Berlin, completed and tested a small radial air-cooled five-cylindered engine of approximately 60 h.p. In view of the fact that, up to the present, Germany has not produced many engines of this size, it may safely be assumed that the new Siemens-Halske engine is likely to become popular in Germany in the near future. The new engine has, we understand, been thoroughly tested, and is said to have given good results. We regret that no figures of weight, revolutions, consumption, etc., are available at the moment, but the following general description may not be without interest.

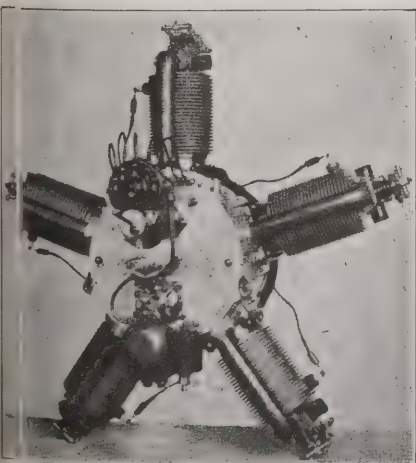
As will be seen from the accompanying photographs, the Siemens-Halske engine, with but five cylinders, is of very clean appearance, and should not, with suitable cowling, offer a great deal of air resistance. It is of the four-stroke type, with two valves to each cylinder. The bore is 100 mm., and the stroke 120 mm. The cylinders are of steel, with aluminium jackets having fins machined on them for cooling. The pistons are also aluminium, or aluminium alloy.

The aluminium crank-case is in two halves, and the flanged cylinder bases are bolted to it with four bolts each. As already mentioned, there are but two valves per cylinder. The inlet valve is operated by double rockers actuated by a push rod from the cam gear on the front of the engine. The exhaust valve is operated, also *via* push rods, by a single rocker arm, placed between the two rockers of the inlet valve. All rocker arms are carried in ball bearings. The valve stem guide of the exhaust valve is situated inside tubular T-piece, so that the exhaust gases es-

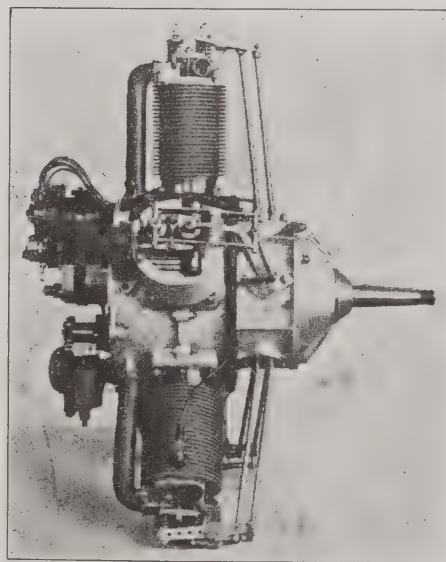
cape through two openings. We believe that the manufacturers have designed a standard exhaust ring collector for this engine, so that from each exhaust valve cage, two short L-pipes run to the exhaust ring, which is placed *behind* the cylinders, and from which a single exhaust pipe projects upward in the typical German style. In the accompanying photographs this exhaust collector ring is not shown.

The rear portion of the crank-case contains the induction chamber, from which the various inlet valves are supplied through straight induction pipes bolted to the crank-case, and to the inlet valve cages. In the front portion of the crank-case are housed the cam discs and the thrust race. Needless to say, the camshaft, which is in two parts, runs in ball bearings. The high tension leads to the sparking plugs are housed in a ring on the front of the engine, and a single pipe carries all the leads from the magneto, which is mounted on a platform on the rear cover of the engine. The oil pump, which forces oil through the hollow crankshaft to the big ends, is also mounted on the rear cover of the crankcase. In its present form, the engine is provided with but one magneto, and there is only one sparking plug per cylinder, but we understand that, if desired, the manufacturers can supply the engine with complete dual ignition.

We hope that later some particulars relating to weight, r.p.m., fuel and oil consumption, compression ratio, etc., may become available, when we shall hope to publish them in AERIAL AGE.



Front View



Side View

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Bird Flight Principles Compared to the Modern Aeroplanes

By F. F. Davis

THE study of bird flight resulted in men learning to fly, but have they not failed to use the great lesson of the bird's economy of power? And is the aeroplane, as we know it today, the best type of flying machine that can be built? To many, bird flight is a profound mystery, and some say it is impossible to learn much concerning it. Valuable information may be gained, however, by reading the works of the following: Etienne Jules Marey, Otto Lilienthal, F. W. Headley, James Bell Pettigrew, J. W. S. Rayleigh, Prof. S. P. Langley and many others. It will be found that some of these men have made long and careful studies of bird-flight and have used many instruments of their own invention for just that purpose.

By the use of electricity and photography, data has been gathered on the movement and power of birds' wings, close enough for practical purposes. It is found to be something like the following:

	Wing Span	Support- ing Area	Weight	Horse Power
Condor	9-10 ft.	10 ft.	17 lb.	0.05
Turkey B'zard . .	6 ft.	5 ft.	5 lb.	0.015
Wild Goose . . .		2.7 ft.	9 lb.	0.026
Pigeon		0.7 ft.	1 lb.	0.012
Humming Bird . .		0.3 in.	0.02 lb.	0.001

Enough Birds to Use One Horsepower
Wild Geese . . . 346 lb. 101 sq. ft. 0.27 sq. ft. per lb.
Pigeons 83 lb. 58 sq. ft. 0.7 sq. ft. per lb.
Humming Birds 15 lb. 26 sq. ft. 1.73 sq. ft. per lb.

By square feet is meant, square feet of supporting surface.

The best commercial monoplanes and biplanes early in 1922 did not carry in excess of twenty pounds per horsepower total weight, and the pay loads were near these figures:

Junker	3.54 lbs. per horsepower
Zeppelin Staaken . .	1.77 lbs. per horsepower
Bleriot Mammoth . .	4.29 lbs. per horsepower
Fokker	4.77 lbs. per horsepower
Spad S-33	5.92 lbs. per horsepower

Aeroplane engines weigh from 1½ to more than 2 pounds per horsepower, and yet two pounds of the muscles which move birds' wings give only a very small part of one horsepower.

Aeroplane builders took the soaring or sailing bird for a model, but the flapping wing birds are far more economical in power expenditure. It is thought by many that in order to procure the same economy of power attributed to birds, it would be necessary to imitate every movement of the bird's wing, but in making machines to substitute the worth of the human hand (some far more complex than the flying machine we are thinking about), different movements are nearly always used to do the same work and it has been done

faster and cheaper, too. Now the hand and arm perform more difficult and complicated movements than the wing of any bird.

For more than 25 years I have taken a deep interest in flying machines, having studied those that can fly to understand why they fly, and those that do not fly, to understand the reason for failure and to ascertain the good points in those failing to discover what features might be made use of. In 1919 I built a model flying machine on an entirely different principle from the aeroplane, which ran with a 2½ horsepower bicycle engine; it was geared back from the engine, but the engine was run up to its full speed. It is taken apart and is now in storage and I am anxious to build another as I now have more time, lighter materials and less to interfere with me while at work. I do not know of many men working on machines using this principle, but I am anxious to see some one build one well enough to show that it is far better than the aeroplane which has a propeller revolving cross-wise from the line of flight, giving a thrust of little more than three pounds per horsepower, with a great amount of wing surface that is a constant drag, that requires a specially prepared landing field and lands at a high rate of speed.

More people should study the flapping wing birds, swans, geese, ducks and many smaller birds, to appreciate the long distances they travel in a short time without depending on air currents.

It has been said that the reason birds fly with so little power is because they are so small, but study the figures given above comparing them with those stated in Prof. S. P. Langley's book "The Greatest Flying Creature" and this "reason" does not hold true.

The smaller the bird the greater the loss of power, and the more surface per pound required for its support. The swan weighs as much as 28 pounds and carries this weight far and fast on wings that are small for its weight. This is not done by any trick, but by a scientific principle of getting a fulcrum on the air, which is about 773 times lighter than water. The wing is a lever of the third class.

In making a machine to do the work of a hand or a wing or a leg, it is, of course, always better to use rotary motion rather than backward and forward motion in all parts that are suited to it and to use as few parts as will do the work in the right way with the least power.

It is important that our men of today use as a foundation the scientific knowledge

that these pioneers have recorded in their books, and combine it with a knowledge of modern machinery and methods. It is important to the world generally who have upon the idea, but it is very important to some one does.

When the main principle of bird-flight is applied to transportation then civilization will take its next and greatest leap forward.

I wish to find others who are working along the same lines and would like to correspond with me.

Let each one do his own thinking and build his machine in his own way, but an exchange of ideas would be good, and anyone is of the opinion that I may have stumbled on any little bit of knowledge by my reading that they have chanced to mention let them write to me at 268 Willis Avenue Bronx, New York City.

Hittle Tractor Hydro

THE Hittle tractor hydro recorder holder is of good design as its record of performance would indicate. A record flight of 116 seconds has never been approached. The former record was only 29 seconds, making Mr. Hittle's flight the more noteworthy.

Every possible method was used to cut down weight and resistance in every part of the model. This resulted in a total weight of only 1.75 ounce and an excellent glide of 8.75 to 1.

This model is a very stable flyer despite its light weight and large surface. It usually flies only 15 or 20 feet above the water but finishes up its flight with the motor practically all unwound.

Motor Base & Tail

A single white pine stick 5/16" deep and 45" long forms the motor-base. On the front the I. M. A. C. type of bearing for the propeller is bound and glued with cello base dope which is used on all joints. At the rear of the stick a piano wire hook for the rubber is attached.

The horizontal tail consists of a piano shaped plane measuring 8" x 12" attached to the underside at the rear of the motor base. The rudder, measuring 3½ to 3½ attached at the rear of the rubber hook to the horizontal plane.

Wing

The wing is built of two white pine beams with ribs and tips of bamboo. A span of 43" and a chord of 5½" makes an area of 215 square inches. A slight dihedral is given the wing. The trailing edge is longer than the entering edge and the ribs are somewhat oblique in order to secure an even spacing.

The wing is fastened to the motor-base

with two bamboo clips which permit of adjustment. The wing is set at an angle of 4 degrees with the line of thrust. The wing tips are curved up slightly at the rear.

Floats

Two neat floats which take practically the whole weight of the machine are mounted directly under the wing, just far enough to the rear of the center of gravity that the model will not tip backwards. The single float of triangular section is just behind the propeller. The floats of bamboo construction are fastened to the frame with streamline bamboo struts.

The weight of the floats and struts complete with struts is only .23 oz.

Power Plant

The four-bladed propeller has a diameter of 10" with a theoretical pitch of 14". Two two-bladed propellers carved alike from $\frac{5}{8}$ " thick planks are joined together. The blades are fairly narrow, tapering most to a point at the tips.

Five strands of $\frac{3}{16}$ " flat rubber drive the propeller at about 760 R. P. M. when in flight. The rubber was only given 1500 turns when it made its record flight and it wound less on the other trials, showing it to be capable of even longer flights.

The Lathrop Tractor Model

ATHROP'S tractor has an official record of 240 seconds, which is the best performance ever officially made by a rubber-driven model in this country. At the end of the record flight the model disappeared from sight at the end of four minutes and, from what the observers reported, it seems probable that the machine went much longer. It was never found, although the surrounding territory was carefully searched.

There is nothing in the details of the machine which needs a lengthy discussion, as the drawings clearly show the general construction principles. There was no use of the standard type of cans used on the machine attached at the center of the motor-base. Three strands of $\frac{3}{16}$ " flat rubber were used, giving the ten inch diameter twelve-inch pitch propellers a 90 second motor run. This run was sufficient to make the model climb out of sight on the several flights of the model before it was lost on the longest of all time. The motor base was about $\frac{3}{8}$ " high.

The total weight of this wonderful model was $1\frac{1}{2}$ ounces complete. Though this was a wonderful model it is *not impossible* to make one that will beat it! Mr. Lathrop worked long and hard on models before receiving the reward but it is some reward—the longest officially timed duration flight of any model aeroplane ever flown anywhere in the whole world and, for all the witnesses of the flight know, it may still be going!

Cook 45 Riser

THE Cook 45 riser is of the twin propeller, pusher type. The two propellers are 12 inches in diameter, made from blanks $\frac{3}{4}$ inch thick. They

are alike except that they are cut to turn in opposite directions, both revolving outward from the center on top. The blades have a width of 1" and are $\frac{1}{16}$ " thick. They are sandpapered, varnished, and finally balanced in order to ensure smooth running. Shafts of No. 16 piano wire are fastened in each and bent in a hook to receive the rubber.

The frame holding the rubber is made of two white pine strips 39" long and $\frac{3}{8}$ " x $\frac{1}{8}$ " in cross section. In the front they are tapered, glued and bound with silk thread. A piece of No. 16 piano wire is bent to form two hooks for the rubber, and is bound on. These strips are separated by two "X's" and a straight piece of bamboo $\frac{3}{16}$ " x $\frac{1}{16}$ " in cross section, bound on with thread. The brackets for the propellers are made from No. 12 wire flattened and drilled for the shafts, glued and bound to the strips. Small copper or brass washers are used to reduce the friction.

The front plane measures 14" x $3\frac{1}{2}$ " and is made of $\frac{1}{16}$ " round bamboo. The three ribs are given the curvature of about $\frac{3}{16}$ " by bending the bamboo over a flame; any low flame such as a candle being satisfactory for this. The rear wing is surfaced on both top and bottom. The two wing spars are $\frac{3}{16}$ " x $\frac{1}{16}$ " set with the small edge up. They run the full length of the wing. The ribs are $\frac{1}{16}$ " x $\frac{1}{8}$ ", double, one on top and one below for each complete rib. The edges are of $\frac{1}{16}$ " square bamboo. The wing is covered on top and bottom with tissue paper. After covering the paper is treated with banana oil to shrink it.

The landing gear is made of No. 16 piano wire bent to the shape shown in the drawings. The wheels are cork, carved with a razor blade. They have a small piece of brass tubing for the axle bushing. All joints are soldered. The rear skid is also made of piano wire bent to shape and soldered.

One and one-half ounces of strip rubber is divided between the two motors and is hung loosely between the two hooks. In emergency, if strip rubber is not obtainable, long narrow rubber bands looped together will do the work. In the front end the rubber should be attached to "S" hooks which permit it to be detached and wound up with a converted eggbeater. When winding the rubber up, it should be stretched to $2\frac{1}{2}$ or 3 times its normal length and then gradually shortened as it is wound. In this way many more winds can be safely given to the rubber.

Pond Indoor Model

THE Pond indoor model is a very slow and consistent flyer. At a contest in which this model made the flight of 170 seconds, the other two official flights were 160 and 164.6, making the average 30 seconds more than the former indoor world's record.

The builder of this model examined all

of the available models around and selected parts on one and parts on another to copy for the present model. The best parts from each model were used. The resulting model won for the constructor a pair of racing ice skates.

Frame

The frame of the model is of balsa wood. The front of the stick is strengthened by a protective coating of Ambroid, about $\frac{3}{4}$ of an inch back from the nose. This prevents the soft balsa wood from being chipped and broken at the part of the motor-base which is most likely to be broken.

The "cans" and tail-pieces are fastened to the motor-base by means of Ambroid cement. No experience of parts so fastened of coming loose was encountered.

The frame barely stands the strain put on it. Two strands of $\frac{1}{8}$ " flat rubber are used. This amount of rubber with a little slack was wound 1125 turns on the record flight.

Propeller

The 12" oar used on this machine is also of balsa wood. It is very thin. The shaft was secured in place by a drop of Ambroid on both sides of the propeller. The tips of the propeller are rounded only slightly, as shown in the drawing.

Wings

The wing is of bamboo construction. The ribs, beams and tips are fastened together by butt joints, with Ambroid cement. The wing is not very flexible in flight, but it is very flexible to handle. The incidence of the wing is adjustable to some extent by a fairly deep "can" at the rear of the wing.

The tail-plane at the rear of the motor-base has two degrees of negative-incidence, which, with the bend in the motor-base, gives the model a rapid climb. The paper on the wing and tail surfaces is not doped. The wing tips are rounded to prevent the twisting of the wing due to any uneven pulling of the paper.

The tissue paper was selected from about about 20 sheets for light weight.

Weights

The total weight of this machine is .19 (nineteen hundredths) of one ounce. The weight is distributed as follows: Rubber motor .06; motor-base .05; propeller .03; wing .05 of an ounce.

The total area of the wing is 62 square inches. The loading per square foot is $144/62 \times 19/100 = .441$ ounces per square foot. With such a large wing and so little rubber, the speed of the model is just about the rate a person normally walks.

The skid shown in the drawing in dotted lines is one suitable for using in case an R. O. G. machine is desired.

Pond Tractor Model

THE tractor distance model designed by Bertram Pond is of standard design, with the exception of the hollow

spar motor-base used. The record flight of 2,465 feet, accomplished on an unfavorable day, makes Mr. Pond's flight more noteworthy.

Even on a day when snow was on the ground a flight of 1,565 feet was made.

It is the light yet sturdy construction of the model which makes it independent of weather conditions. The total weight with six strands of 3/16" flat rubber is 1.47 oz. The glide ratio with the propeller off (but with the rubber on) is six to one.

Motor Base and Tail

A channeled spar with walls .025" to .028" thick with a cap of the same thickness glued on to it, forms the body of this machine. The stick is 3/16" x 7/16" in cross section and 33 3/4" long. (See detail drawing in the June 19th issue of AERIAL AGE). The channel was gouged out with hand tools and sandpapered to size, which was held to limits by the use of a micrometer. The cap was planed on a piece of plate glass for flatness, using a very thin

cut. The cap was glued on with LePage's glue after the inside had been doped with banana oil.

The usual hook and bearing are fastened to the front and rear by Ambroid. Two 7/16" opening "cans" are used to prevent the motor-base from buckling.

The horizontal tail is formed of two bamboo strips with a split silk thread edging. The vertical member fits in the hollow of the spar, and it is of a shape to prevent warping.

The weight of the motor-base complete with fin is .35 ounce.

Wings

The wing is built up in the standard way with round tips to prevent warping. To counteract the efficiency loss accompanying a large dihedral or the loss of stability when the center of thrust is above the center of pressure (due to the depth of the motor spark) the front wing spar has a decided offset downwards sufficient to make the proper incidence and dihedral

with both wing beams flat on the motor base. Also the center of pressure is raised without increasing the dihedral. The right side of the wing has more incidence than the left to take care of the torque of the propeller. The clips which hold the wing to the motor-base weigh 1 ounce.

Power Plant

The large 15" diameter 19 1/2" pitch propeller is driven by six strands of rubber weighing .7 ounce. Propeller weight 1 ounce.

The rubber was given 825 winds on record flight but will stand 1,200 as proven later.

This model holds the unofficial H.A. Launched Distance and Duration Record with 6,300 feet and 522 seconds to its credit. It is a consistent flyer, having made 910 flights all over 1,500 feet. It usually climbs to a good altitude finishing up a flight in a very long but apparently steady glide, with the motor all unwound.

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PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
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BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

THE JUNIOR CLUB OF AERONAUTICS,
KANSAS CITY, MO.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

FLIGHT ASSOCIATION OF OTTAWA, CAN.
c/o Mr. Oswald Barry,
117 Albert Street, Ottawa, Canada

(Concluded from page 399)

second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before 5 p. m.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks indicating this line, after having completed the full course, approximately 240 miles.

5. WINNER:

The winner of first place in the race proper shall be the pilot who has completed the full course in the shortest elapsed time, and second place the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS:

All pilots must hold an Aviator's license issued by the Federation Aeronautique Internationale and duly entered upon the Competitor's Register of the Aero Club of America.

7. RULES OF THE RACE:

(a) Pilots must hold a straight course

after starting until they have gone the distance to be specified and marked.

(b) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(c) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(d) Pilots shall pass all turning points in plain view of the observing officials stationed at each turning point and at an altitude of not over 500 feet.

(e) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the Field, and land in that part of the Field assigned for landing and in so doing shall not cross the course or finish line.

Any contestant breaking any of the foregoing rules of the course, or subsequent ones which may be officially announced in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of the Detroit Aviation Society, Inc., within twenty-four hours after the finish of the race.

9. NUMBERS:

Each aeroplane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of lower wing and on each side of the fuselage, clear of the wing, in characters as large as

possible. It shall have no other numbering or lettering over 12 inches in height.

10. No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzene and similar anti-knock fuels may be used.

Event No. 5

Pulitzer Trophy, Saturday, September 16. Cash prizes: First prize, \$1,200; second prize, \$600; third prize, \$200. Free-for-all race for high-speed aeroplanes.

1. CONDITIONS OF CONTEST:

(a) Factor of safety—Monoplanes, 6; as loaded for start of race; biplanes, 6; as loaded for start of race.

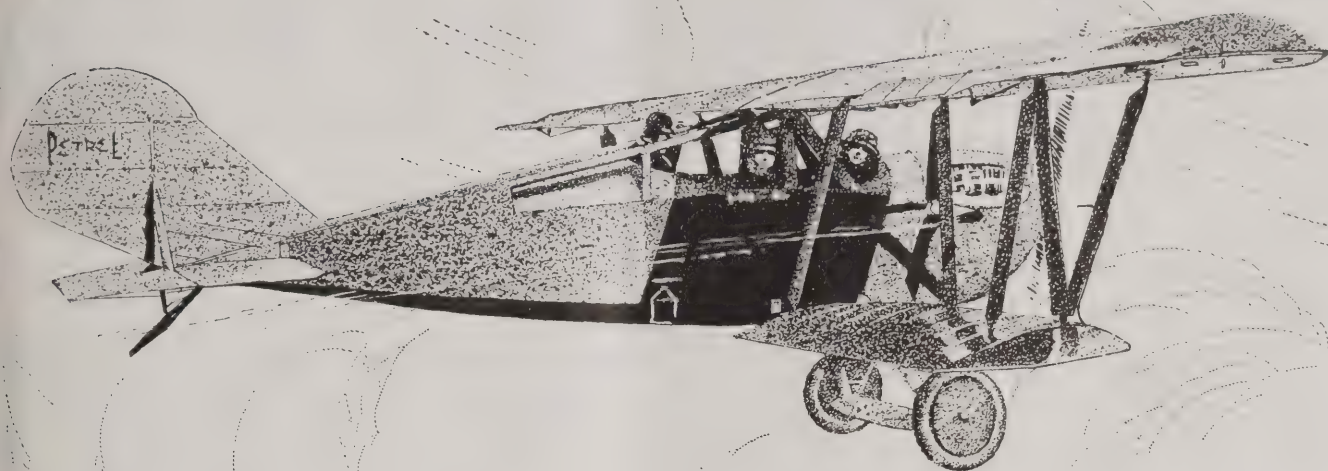
(b) Air speed greater than 140 miles per hour, as loaded for start of race.

(c) Landing speed not to exceed 50 miles per hour in still air. (See footnote).

(d) Visibility and maneuverability (land and air) which, in opinion of Contest Committee, is not a menace to other contestants or spectators.

2. DISTANCE:

Approximately 160 miles, four times around a closed course of 40 miles, starting at Selfridge Field, thence west to captive balloon, thence to Packard Field and return to Selfridge Field.



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(Continued from page 408)

board of which General Shanks is president. Representations of the need of relief having been made by General Patrick, chief of the air service, it is hoped that some remedy will be recommended from that quarter requiring, of course, legislation. What this will be is not made known, but it is presumed that some plan will be adopted to place the air service personnel on a separate promotion list, after the manner of the medical corps, with possibly, promotion by length of service, although that is not essential, provided the advancement is made equitable as vacancies occur with the fair distribution of original air service officers to the field grades, from which they are now hopelessly excluded,

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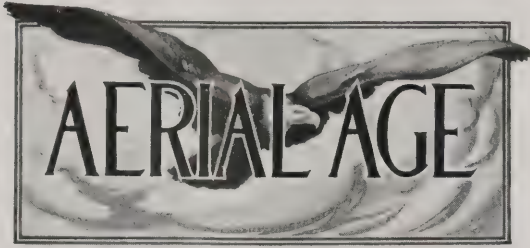


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or that the younger officers will be distributed on the present promotion list more equitably according to their actual length of service. This separation of air service officers from the promotion list would not, it is pointed out, interfere in the least with advancement in other branches, excepting in so far as such officers would benefit from air service vacancies. It would be justified, it is urged, by the fact that the casualties are so prevalent in time of peace. It is expected that same important announcement of interest and importance to air service officers will be shortly forthcoming in the report of the board engaged in a study of the promotion list. The impression prevails that, if the War Department approves of any recommendation of this character, there will be no difficulty in obtaining the necessary helpful and corrective legislation from Congress. A striking illustration of the disadvantage under which the air service is placed is afforded by the fact that of the officers now eligible for promotion in the various grades there are no air service officers among the 24 lieutenant-colonels, only one (Foulois) among the 30 majors, only one (Houghton) among the 67 captains, and 24 among the 152 first lieutenants. It is interesting to note that practically all of the 24 officers who are eligible for advancement from first lieutenant to captain are those who were originally commissioned as ground officers or transferred into the air service from other arms in which they were initially commissioned, this being due to the fact that the bulk of all the original flying officers are still a considerable distance from the junior officers in the list of first lieutenants for whom there are vacancies in the grade of captain.—*Army and Navy Register*.

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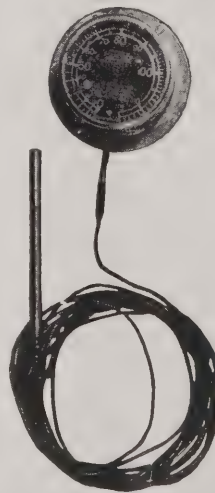


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Commercial Aviation Ready For Its Broadcast

By John Walker Harrington

THE era of air travel is close at hand. Its coming is foretold not so much in words, as between the lines of that comprehensive review of the progress of aviation in 1921, just issued under the auspices of the Aeronautical Chamber of Commerce. Indeed, the very existence of such a body as the Chamber is an augury that the flying art is ready to sweep over the Rubicon and make good its complete conquest of the air. The Year Book for 1922 furnishes facts and figures in which all of us may read the bright hopes of the future. What will be the magic word which will bring aviation into its appointed place? How shall it find, especially in these United States of America, that definite urge, equivalent to the establishment of broadcasting stations which transformed radio from the fad of the few into the marvel for the millions?

As was the case with wireless telephony, commercial or civilian aviation needs most of all the establishment of focal points throughout the country and the cooperation of government. Whether or not it would be helped by a subsidy is a moot question, but there can be no doubt that the aid of all authorities, Federal, state, and local would give to the art an impetus which would soon carry it into the landing fields of popular approval.

Aviation just now is at the point in the United States which was attained by steamboating just about a century ago. The wiseacres of 1822 were becoming convinced that although God had given a grade to the rivers which made them flow down hill, that it was not flying in the face of Providence for man to make a craft which would go against the current. Many feared to commit their lives to the new fangled craft but there were plenty of venturesome souls willing to take the chance. Then came the railroads, built in the face of great opposition, for there were those who thought anything faster than the trot of a horse was harmful to the constitution.

That the public has confidence in the skill of authorized air pilots in this country is revealed by the report that in 1921 there were carried 122,512 passengers by commercial aircraft, as compared with the 115,163 who availed themselves of aerial transport in the previous year. The mileage flown, as officially recorded was 2,907,245, which indicates a very healthy state of the art, for although it is a trifle less than the 3,136,550 of 1920, it included less free and more paid flights. If the activities of those birds of passage, the gypsy fliers, are taken into the account, the actual number of passengers who took the air may have been about 250,000 or

a quarter of a million. This would bring, as estimated in the Year Book, a total mileage of approximately 6,250,000 miles.

The gypsy flier is not so unmixed an evil as the gypsy moth. His zeal has done a great deal to advertise aviation to the American people. When he drops down from Nowhere and induces Squire Bill Jones to take a jaunt into the ether, he does put aviation on the map. If he brings the Squire back safe and sound, he induces all the leading citizens of the vicinage to take a flyer and makes cloud hopping the rage. It is a lamentable fact that most of the casualties of the last year were due to the aerial tramps and to the doers of stunts. There were no lives lost through the operations of the duly organized companies, whose machines were in charge of efficient and conservative pilots. There has been a surprisingly large amount of passenger traffic, despite the phobias and the misgivings promoted by the alarmist accounts of accidents printed in the popular press. Many thousands of persons are now traveling by the ethereal routes as a matter of course, and they have done a great deal toward bringing aviation into common use. In some regions, the aeroplanes are going and coming like taxi cabs.

Private owners, such as Mr. Vincent Astor, use them as unconcernedly as though they were riding in their own automobiles. A group of friends of the young millionaire, the other day, made a flight from Port Washington to Newport in eighty minutes, and the newspaper accounts of the flight brought out the interesting circumstances of his own journeyings through the air to boat races and ball games. When the exact details of flights are more fully reported in the daily press, and the newsboys cease to cry "Terrible Accident" every time a pilot runs out of gasoline and has to volplane into a cornfield, the art of flying will be well on its way toward becoming one of our most popular outdoor sports.

What most is needed, in the opinion of those who would see the rapid advance of American aviation, is a through air route over which the public may be taken at night. Owing to the scarcity of terminals and the paucity of emergency landing fields, such a plan cannot be fully carried into execution. Suppose, though, that the trip could be made, as has been suggested, from New York to Chicago, without any overnight stops—one long and steady hop. When Mr. Robert Fulton took the first commercially successful steamboat up the Hudson, he had the Clermont tied up over night before the trip was much more than half done, for it would have seemed too much of a strain to have expected of a new mechanism, that it should go in the dark as well as in the light of the sun. When suitable lights and marks and fields can be made ready, however, there is every reason to believe that aviation

will get much of that popular urge which is so necessary to putting it on a broad commercial basis.

The way certainly has been blazed for the art by President Harding by his advocacy of the Aerial Code, which will be a great encouragement to Civilian flying. The bill now pending before the House which would regulate the operation of aircraft in state and interstate commerce, and establish a Bureau of Civilian Aeronautics in the Department of Commerce will be an efficient guide to the new order. A huge aerial highway, like the Lincoln Highway of the land, over which could course the argosies of peace letting down their passengers as well as their "golden bales" would do much toward establishing air travel on a parity with vehicular transportation on the land. Just as the efforts to give to this country well ballasted and macadamized roads, has stimulated the production of automobiles, so the marking out of some great aerial trunk line, to be followed with ease and safety by night and day, will do much toward giving to aviation its popular broadcast.

Long distance aviation, although there have been some phenomenally sustained flights, is still young, for the 1922 Year Book tells us that the average duration of the 130,736 flights made in 1921 was only twenty-one minutes. There must have been some very short essays of the bright empyrean, indeed mere glimpses of cloudland, to bring down the average so low. The lack of facilities is a factor in this, for although there are 146 terminals now as com-

pared with the 128 of 1920, air travel is still much handicapped for the lack of ports. When commercial aviation comes into its own, aircraft should be able to keep much busier.

The 1200 craft now in commission have made little more than a hundred and ten flights a year each although their number is twenty percent higher than that given in the 1920 census.

Passenger rates are coming down by the way, as the average charge for the short flights in this country is now \$9, whereas the 1920 rate was \$12.50. The usual rate per mile charged for the inter-city flights is now 55 cents, a decrease of ten cents from the fare of the previous year.

Aside from the brief excursions skyward, commercial aviation ever now is providing some well sustained travel programmes. The Aeromarine Company for the sum of \$75, one way, transfers passengers from Key West to Havana or vice versa. The schedule provides for a flight of an hour and a quarter and, it is advertised, that the passengers save seven and a half hours, as compared with the length of time which would be required on the water trip. The same company has also been successfully operating a line of aeroplanes between New York and Atlantic City.

The Curtiss Northwest Aeroplane Company is running its aerial cruises from time to time from various points to Minneapolis and St. Paul. Out on the Pacific Coast Walter T. Varney is furnishing air transit to the California sightseers.

One of the most significant developments of commercial aviation is the transportation of both freight



G. Elias & Bros. Commercial Type Aeroplane, built in Buffalo, N. Y.



Jackson Park Yacht Club, Chicago, Ill. Photographed from a Ralph C. Diggins plane

and passengers in Larsen monoplanes from Edmonton into the Canadian oilfields. Prospectors and promoters save many days by this course, as they otherwise would have a long and tedious way by land and water. The Larsen interests have been doing a remarkable service all over the United States in giving educational flights and in converting thousands of persons to the higher life.

The epigram that the automobile industry is merely an infant, and that commercial aviation is unborn, is hardly justified by such records as are here cited. If civilian air travel is still to see the light, it is certainly a very live and kicking embryo, and even now it compares favorably in many ways with similar flying in Europe.

What with government aid, and the earnest cooperation of the large manufacturers, which is still more important, perhaps, European public flying is so far advanced that the air excursions are referred to as ordinary methods of transportation for tourists. Americans returning to this country start a thrill or so, by telling of their adventure in crossing the English Channel on their way from London to Paris, but Englishmen

and Frenchmen regard all such expeditions as part of life. Dining at sunset at the Savoy and supping at the Ritz are pastimes for romantic bridal couples, and before long they will be undertaken in staid and sober fashion by other "respectable married people with umbrellas," as Stevenson used to say of the volcano visitors.

French commercial aviation is certainly proceeding apace, for the cables bring the news that this last June alone, 544 planes arrived or departed. They transported in that period 2,058 passengers, 56,360 kilograms (about 120,000 pounds) of merchandise, and 472 kilograms of postal matter.

British commercial aviation has also been on the quiver, for it is reported that up to September of last year 671 planes had been in commission going and coming from the Continent with 4,006 passengers. In England there were 31,853 passengers carried.

The business of transportation of freight and express matter is well under way on the other side of the Atlantic, for England sent away air exports valued at 110,400 pounds, while her imports from beyond the

choppy channel were 206,357 pounds. Costly hats, rich perfumes, small works of art, notably Chinese porcelains and Old Masters, are often sent from Paris to London by air.

Germany for many years has had established air transportation facilities and now has ten aerial trunk routes. Flyings beyond the Rhine proceed in regular schedule and passengers and freight are conveyed quickly from place to place.

Although the layman does not yet realize it, there has already developed in this country something of an "Overland" freight service. The editor of the Year Book tells us that American aircraft in 1921 carried 123,227 pounds of goods, or about three times the amount transported by air in 1920, which was 41,390 pounds. Much of this merchandise, it is true, was carried for advertising purposes or for the introduction of products. In a practical way and as a matter of routine, however, many large wholesale drug houses are shipping valuable medicines, such as toxins, in this way, while silk dealers and jewelers often resort to the air routes for quick delivery of their wares. In regions where civilization is not always on guard, such as

among the gold and oil prospectors, there is a dearth of soap which is often met by the speedy aeroplane.

The managers of the large express companies in the United States have already put themselves on record as favoring the carrying of packages of value by aerial routes. They believe that the development of the Air Mail Service of the United States, which is doing well despite many drawbacks, will bring about a steady demand for transportation of compact and valuable goods "via Cloudland." The details of aerial freight transport are being worked out so closely these days that it will only be a question of time before railroad and express companies will recognize in aircraft companies formidable competitors.

The flying machine may be made to serve the financial interests in all directions, especially in the transportation of checks, drafts, and other business papers, and thus it will become the ally of the Clearing House and the Federal Reserve Bank. Finance and commerce are vitalized by dispatch and they are willing to pay the cost of creating it. Commercial aviation will ascend still more toward the star of success, as its appliances are more and more adapted for the traffics and discoveries of peace. Much genius and patience was devoted to the building of planes for war purposes. Lightness of construction and speed were important requirements in the conflict and the

military aviator was not so much concerned about his own safety as the prospect of bringing down an enemy. The open cockpits and the long, low rakish bodies are essential to military operations, but now the trend is toward craft which will be comfortable for the passengers. Then will come the staid folks who won't even put on several thicknesses of jackets, and goggles, but will sit in the cabin behind the mica windows, in ordinary attire and sip lemonades or anything else beyond the three-mile limit, and read the magazines while the world goes by underneath them. These passengers of the morrow must have all kinds of conveniences and they will forget about the risks, and only know where they are, probably when they feel the machinery throbbing only feebly and are aware of the downward drag.

There are the genius and the inventive skill in the United States which will make possible the building of aircraft which will meet every requirement as passenger carriers and cargo bearers. The difficulties of air travel, and for that matter, those of safely piloting the planes, have been much exaggerated. With a public which has a sportsmanlike quality and with cool and experienced pilots, the ordinary problems of aerial traffic can be readily solved.

Now is the time, then, for Congress to give the word to go ahead, by

adopting without delay the Aerial Code. If this be followed by a consistent and aggressive policy of development in the naval and military aviation, and all efforts be used to make the Air Mail Service a notable success, commercial flying will win more and more of popular favor. What is needed at the present time is concentrated effort on the lines of demonstration. If the large aeroplane manufacturers will help in the worthy cause of spreading the gospel of safety by establishing or promoting through air routes, the public will have daily assurances that aviation is a sane and riskless pastime, within just the same limits, at least, as railroading and automobiling are not perilous. Foreign aircraft corporations have been so wise and far seeing as to aid in this policy, and thus cooperate with the various governments.

The speedy enactment of an Aerial Code by Congress would make possible a general national campaign in the interests of commercial aviation, as it would clear the air of many vexed problems. Then it would be possible to gain the full cooperation of the authorities, national, state and local, and of the manufacturers and various air transportation companies, in the development of air ports, terminals, emergency landing fields, and all those facilities needful for the symmetrical and orderly development of the Icarian art.

Vital Importance of the Detroit Races

By Harold E. Hartney

IT was not many years ago that a small town in Ohio passed an ordinance prohibiting the railroads from laying tracks through the municipality. The village solons had decided that the railroads traveling at the inconceivable speed of fifteen miles an hour would be a menace to human life and property. Times have changed, to be sure. The Twentieth Century Limited and the highly developed motor car have accustomed us to forty, fifty and on occasion sixty miles an hour. For several years now it has been a fast life. But when the thousands gather at Detroit, Michigan, in October to witness the National Aeroplane Races they will, without question, see such speed as to convince them that another and superlatively fast era is dawning. As this is written there are more than fifty entries for the

various events sponsored by the Detroit Aviation Society, which has been working for several months, actually working, to the end that this year's great races shall be known as the greatest flying meet ever held, in America or anywhere else.

On the last day of the races, which commence with the Curtiss Marine Trophy Race on October 7th, and conclude with the Pulitzer Trophy Race, the crowds will witness the most significant and vitally important contest ever staged on this hemisphere, and possibly, many believe, in Europe. There are twenty-three confirmed entries for the Pulitzer race alone and still others to come in before the list is closed. All the machines bear the technical description of pursuit planes. A majority vary in design, motor power and construction. Some are of metal, others of wood, and others of wood

and fabric. Several will have 600 horsepower motors, Packard type, which General Mitchell recently pronounced one of the most efficient aeroplane engines yet developed. He added that if there had been any bugs in the Packard 600 (and no motor was ever produced that did not develop bugs in its initial stages), said bugs have been exterminated by the combined efforts of the Packard engineers and the scientists working with the U. S. Army Air Service. Great things are hoped for the Packard. Then there are the Curtiss and Wright motors, both of which possess excellent records for efficiency. The Curtiss and Wright motors showed their teeth at last year's Pulitzer; while the Packard, then in an experimental state, won out in the 1920 classic. The motor contest will be worth watching.

(Concluded on page 474)

Building Our Cities in the Country

By R. R. Blythe. R. A. F.

COMMERCIAL aircraft in America traveled 6,500,000 miles during 1921. Six million miles in the air in one year! There can be drawn only one conclusion from this statement and that is that where we have now flown a distance sufficient to convince the public of practicability of aviation, the future lies ahead in an unlimited broad expanse of development.

Our national yearly average is something like 9,000 deaths in automobile accidents compared with only fifty-five deaths caused by aircraft. Yet the great majority of the American public today will point out that flying is unsafe. The reason of this lies directly in the fact that our newspapers have impressed upon the public at every opportunity by featuring aeroplane crashes that there is still a grave danger in flying.

Major B. L. Smith, general manager of the Aeromarine Airways, Inc., stated in his address before the Aeronautic Executives that the report in the Sunday newspapers of the crash of the London to Paris air liner decreased the gross income from passenger flights by 100 per cent over the previous Sunday's income.

Yet this great commercial air transportation company now operating in the United States has not had a fatal accident to a passenger on its flying boats in two years' flying history.

In fact, one of the most encouraging signs that the day of profitable and reliable air lines—linking our cities with scheduled passenger, freight and mail service—may not be far distant, is to be found in the report recently submitted to the Director of Naval Aviation by this company, owning the Aeromarine passenger planes. It operates a daily mail and passenger service between Key West and Havana, Cuba, according to the report; also between Miami, Fla., and Bimini, and between Miami and Key West. Its fleet consists of six eleven-passenger converted navy flying cruisers and six five-passenger flying boats. In addition to scheduled service, the company engages in special charter flights.

The Aeromarine flying boats made 735 complete flights, the report points out, in the four months from November 15, 1921, to March 15, 1922, with a record of 640 hours flown, and 268,538 passenger miles. Of these flights, 171 were on the 100-mile Key West-Havana route, while the charter and miscellaneous flights totaled 359.

During these operations, not a passenger nor employee was injured, and

only five boats were forced to return to their bases. The schedules were maintained throughout, with the exception of these five flights, according to the report.

In two years of operation, the report discloses, the company's flying boats in passenger service have flown a distance of more than 150,000 miles, and have carried 10,700 passengers without a mishap.

Our own Air Mail carries its message of safety and reliability on all the trips started between New York and San Francisco for a period of six months there only developed one half of one per cent mechanical troubles that caused forced landings. During this period not a single pilot was injured. Plane No. 189, which is in service between New York and Bellefonte, Pa., has been flown over four hundred hours, or about forty thousand miles and has not yet had a mechanical forced landing.

With these records of safe operation why does not the public utilize this mode of transportation which can carry passengers or freight in half the time consumed at the present time? The answer is apparent, though many have evaded facing the inevitable—the establishing of organized air ports sufficiently available from the centers of commerce.

The distance of these air depots from the centers of commerce is perhaps one of the greatest drawbacks to the development of commercial aviation. Considering New York as a point in question, it is safe to state that not over ten metropolitan mercantile companies have considered using aircraft for transport, and it is equally safe to assert that the inaccessibility of air ports the greatest factor.

Let us therefore consider a main Grand Central Air Terminal at Battery Park in the Borough of Manhattan. Seaplanes running up to especially constructed docks taking on passengers and freight in comfort—the luxurious F-5-L converted Aeromarine Seaplanes with the splendor of comfort and security—embracing from the heart of New York City four or more scheduled flights per day to Atlantic City, Boston and neighboring seaport cities. Every hour large deeply upholstered D.H. 34's of latest type and construction, graceful Fokkers and Junkers monoplanes would take off across the landing field of Battery Park in regulated order, flying to all inland cities with burdens of passengers and freight. How long would it take for the most conservative firm to realize

the possibilities of beating a competitor to a market in half the time that it would take a train to deliver the same goods? Bring aviation to the business centers and you've brought it to the hearts of the public.

Aeronautics will revolutionize the world. This change will not come about in a violent or sudden burst but slowly and steadily as the public realize the greatest of all modes of travel and its uses. All life has depended upon transportation; in the early days the settlers built their homes on the river banks; waterways, railroads and motor roads today form the arteries of all countries.

Many and manifold as are the advantages and attractions offered by the cities, numerous also are its disadvantages and hardships. We cannot look at a city today without seeing its slums and tenements as well as its parks and boulevards.

It goes without saying that thousands of city children grow to maturity under conditions that are as far from inspirational as are those that have hampered the natural development of many a country-bred boy and girl.

Our present system is not sufficiently flexible to meet satisfactorily the variable conditions presented by the human element. And therein lies the overwhelming disadvantage of the city. Expansion beyond a certain point results only in congestion, and this in its various phases lessens the values otherwise growing out of centralization.

In comparison with this we have in America great expanses of uninhabited land which is sufficiently adjacent to alleviate every crowded family in New York. Sweet fertile soil and clean, wholesome air and yet we are crowded to the close quarters of apartments with the noise and smoke, living and breathing, over three million people on Manhattan Island.

The city of the future will be like our congested business sections at night—useful only for centralizing our business efforts and segregating the contact from the home.

Commuting by air will bring in the millions for the day's work and will return them to the pleasant home with spacious ground, where the trout stream bubbles close by and in the early twilight the birds twitter each other to sleep. The commuting will be swift, clean and pleasant, instead of rushing like moles into the subways and trains, where the masses push and struggle, breathing the foul subterranean air in the mad rush of the eight forty-five and the five-fifteen.

- | | |
|--------------|------------------|
| A-London | a-Vitebsk |
| B-Paris | b-Moscow |
| C-Brussels | c-Wangerroog |
| D-Rotterdam | d-Norderney |
| E-Amsterdam | e-Hamburg |
| F-Bremen | f-Westerland |
| G-Berlin | g-Havre |
| H-Hanover | h-Lucerne |
| I-Magdeburg | i-Vienna |
| J-Leipzig | j-Budapest |
| K-Dresden | k-Belgrade |
| L-Strassburg | l-Bukharest |
| M-Prague | m-Constantinople |
| N-Warsaw | n-Bordeau |
| O-Stuttgart | o-Toulouse |
| P-Nuremberg | p-Barcelona |
| Q-Augsburg | q-Alicante |
| R-Munich | r-Malaga |
| S-Constance | s-Rabat |
| T-Stettin | t-Casablanca |
| U-Danzig | u-Montpellier |
| V-Konigsberg | v-Nimes |
| W-Kovno | w-Marseille |
| X-Memel | x-Antibes |
| Y-Riga | y-Ajaccio |
| Z-Reval | |



European Air Travel in 1922

By Edward P. Warner*

OF that horde of American tourists that are already crowding every ship that swings down New York Harbor from the Battery or out past Boston Light, there are, no doubt, many who are planning, whether openly or secretly, to make for themselves a real trial of air transport before they return to the United States. The trip from London to Paris by air has become so much a commonplace that it is included in the itineraries of carefully shielded parties of school-girls, and one seldom hears danger offered as an excuse for not taking that journey at the present time. The expense is still the principal drawback to a more extended use of that and other air routes, and it is admitted by those connected with the administration of the air lines that a large part of the traffic is made up of American tourists.

The general scope of the routes is shown by the accompanying map, on which the designation "regularly operating" is used for lines running at least three times a week in each direction. The routes will be observed to fall into four general classes, those radiating from London, the lines of Southern France and the Iberian pen-

insula, those of Germany and north-eastern Europe, and the French lines running to the east and northeast from Paris.

The failure to establish more extensive direct connection between the German and French lines is the outgrowth of political feeling and of the provisions of the International Air Navigation Convention, in accordance with which communication can only be made through neutral countries until such time as Germany shall be admitted to the League of Nations and allowed to ratify the convention. The failure to link up the lines of northern and southern France is a little more surprising, but can be attributed primarily to the excellence of the terrestrial transportation. A train leaving Paris a few minutes before 8 in the evening arrives at Toulouse at a few minutes after 8 in the morning, in plenty of time to connect with the departure of the aeroplane for northern Africa. It is not economically sound at the present time to attempt to run air lines over routes already well served by the railroads if the distance between the termini of the line is such as to make an easy night's journey by through train. From 300 to 600 miles is the worst possible distance for an overland air

route, since that is the distance over which travel by night presents the greatest advantages.

Turning to the detail consideration of the routes shown on the map, there are five distinct companies operating between Paris and London, and some regularly scheduled journey over that route starts at nearly every hour during the day. The voyager has his choice of a large range of types of vehicles, ranging from the war machine rebuilt to carry four passengers up to the luxurious twin-engined commercial aeroplanes carrying 10 or more and used by several of the companies. The time required for the trip depends somewhat on the type of aeroplane used, but is normally from two and a half to three hours. Between London and Brussels and London and Amsterdam (with a stop at Rotterdam), also, there are daily services, the one to Holland being operated by a Dutch company with Fokker aeroplanes.

The second group of routes includes the comparatively short run from Bordeaux to Montpellier, with a stop at Toulouse, and the line from Toulouse to Casablanca, in French Morocco. The latter is now running five times a week and has been operating for two years without serious

* In the Christian Science Monitor.

accident, although some parts of the territory flown over present great difficulties in case of a forced landing. The whole distance from Toulouse to Casablanca is covered in two short days' flying, an overnight stop being made at Alicante. The time from France to Morocco by air, even including the intervening night, is less than half that required by rail and boat. There are a couple of additional lines which are in intermittent operation in this territory, and those who wish to visit Corsica may be able to make arrangements for crossing from Antibes and Ajaccio by air if they date their trip properly.

The German lines and those running through northern Europe with Paris as a center, can be considered together, although the only actual point of connection between them is Amsterdam. The most important single route is that from Paris to Warsaw via Strassburg and Prague. The journey from France to Poland is being made in one day at present, having been changed from a two-day journey six weeks ago. The total elapsed time from Paris to Warsaw is 11 hours as against 40 by train, and the fare for the whole trip is only 800 francs, comparing favorably with the railroad rate by train de luxe with sleeper.

It will be noted that there is shown on the map as projected an extension of this line from Prague to Constantinople via Vienna, Budapest, Belgrade and Bucharest. It is the present expectation that this line will be operating regularly by the middle of July and it will therefore be available for the summer tourist traffic. The journey will probably be made in two days with an overnight stop at Budapest. The time by the Orient Express from Paris to Constantinople is about 110 hours, so that the saving in total elapsed time will again be more than one-half. When this line goes into effect, the principal cities of every large state in Europe except Bulgaria, Italy, Greece, Russia, and the countries on the Scandinavian and Iberian peninsulas will be connected by air.

Looking the other way from Paris, the line from Paris to Havre is seen to be marked as in intermittent operation, but aircraft meet all the large liners and the voyager can therefore transfer immediately from marine to aerial transport. If it is desired to visit Germany and northern Europe from Paris, the distance from Paris to Amsterdam can first be covered by air in four hours with stops at Brussels and Rotterdam. At Amsterdam one changes for a German-controlled line to Bremen, whence it is possible to fly directly to Hamburg, to Berlin or to Leipzig or various of the islands along the Frisian coast. The definite time-tables are not yet at hand this year for the German lines but it is probable that arrangements

can be made by taking passage from London early in the morning to travel from London to Berlin in a single day.

Arriving at Berlin, further passage by regularly operated lines can be secured to any of the principal cities of the Baltic states as far north as Reval. There has been much discussion of a line to Moscow, but it does not appear to be in regular operation at present. The traveler wishing to visit Soviet Russia late in the coming summer, however, may safely plan on the basis of being able to make the trip from Paris or London entirely by air.

A number of the short lines in Germany have been omitted in this discussion. They are shown on the map, however, and almost all of those there indicated went into daily operation on the 15th of April.

As an indication of what can be done by air, a sample trip may be instanced. A voyager arriving at Havre can go from there to Paris, to Strassburg, to Stuttgart (this last short link by rail) and thence successively to Nuremberg, Leipzig, Berlin, Hamburg, Bremen, Amsterdam and London. The total distance traveled by air is about 1500 miles, while that by rail is less than 50. The journey could easily be made in five days or in four, if one were fortunate in making connections, and the total cost would be about \$135.

Standardization and Aerodynamics

By Dr. A. F. Zahm

In Charge of Aerodynamical Laboratory, Bureau of Construction and Repair, U. S. N.

WITH further reference to the article on "Standardization and Aerodynamics," published by William Knight in the AERIAL AGE of June 20, 1921, and the subsequent discussion in the AERIAL AGE of the suggestions therein contained, as contributed by Prof. Prandtl (October 3rd, 1921), Prof. von Karman (January 2nd, 1922), Col. Costanzi (February 20, 1922), W. Morgoulis (March 6th, 1922), Col. Verdizio (April 3rd, 1922), Dr. Katzmayer (May 8th, 1922), Dr. Wolff (June 19th, 1922), regarding the comparison of methods of aerodynamic measurement and expression, I should say that it would now be opportune to have a representative committee appointed to formulate a program for such work.

The inclusion of a very great number of laboratories in the comparative tests does not seem advisable at

the beginning. If a few of the foremost ones, testing not too difficult models, can obtain identical results, a good start will have been made. Such tests already are in progress in this country and elsewhere, but without a common plan of attack, and without a common formulated theory to furnish guidance and precaution.

The experimental program should be at least as comprehensive as the one proposed by Dr. E. B. Wolff, in the AERIAL AGE WEEKLY for June 19, 1922. An accurate exploration of the air stream, before the insertion of the model and during the test, should especially not be overlooked by the experimentalists. In two papers published by the National Advisory Committee for Aeronautics*, I emphasized this feature when the

* Report No. 139, Influence of Model Surface and Air Flow texture on Resistance of Aerodynamic Bodies.

Note No. 23, Horizontal Buoyancy in Wind Tunnels.

Committee was working on its program for comparative wind tunnel tests.

The most direct way to study accurately and convincingly the correction to be made for Reynolds number v_1/D , in applying model data to aircraft, would be to insert the full-scale craft in a wind tunnel of suitable size. A fully equipped aeroplane, for example, could easily be supported on a wire balance in such a tunnel, and given a comprehensive test when in natural working condition, including its power plant and observers.

Such a tunnel should have a throat measuring in cross-section rather more than 10 x 20 meters, and maintain a uniform air stream at 10 to 30 or more meters per second. The propulsive system required to maintain such a stream, at 100% efficiency, would be of slightly less than

(Concluded on page 474)

Helium

By R. B. MOORE

Chief Chemist, Bureau of Mines

THE story of helium is one of the romances of science. Probably nothing, except perhaps radium, compares with it in human interest. Helium is one of the best examples of a discovery in pure science that has wide commercial application. In 1868, an eclipse of the sun was visible in India, several scientific men who were in India making observations of the eclipse turned a spectroscope for the first time on the solar chromosphere—that part of the atmosphere of the sun, about 10,000 miles deep, which merges into the corona. A bright yellow line was observed and was thought at first to be due to sodium. Janssen showed, however, that this line was not just the same as either D_1 or D_2 line of sodium, although it was extremely close to these lines, hence he suggested that the new line have the designation D_3 . Frankland and Lockyer decided that D_3 was due to an element in the sun not previously discovered on the earth, and suggested for it the name "Helium" from the Greek word "Helios" the sun.

For several years nothing more was done in connection with this element. In 1894, Sir William Ramsay, in conjunction with Lord Rayleigh, made his memorable discovery of argon in the atmosphere, which was announced at the British Association meeting in the same year. After this discovery, Ramsay looked for other sources of the element. Through Sir Henry Miers, he learned that Dr. W. F. Hillebrand, of the United States Geological Survey, had obtained an inert gas from certain uranium minerals, which gas he had decided was nitrogen. Ramsay believed that part of it might be argon; he obtained from Hillebrand for experimentation, a sample of the mineral, cleveite, one of the uranium minerals, and after extracting gas from the mineral and purifying it, he ran it into a spectrum tube. The lines obtained were, however, different from those of argon; among them was the bright yellow line noted by Janssen. Thus was terrestrial helium discovered.

Helium was found in the atmosphere, in the proportion of one part by volume in 185,000. From samples of air taken at an altitude of several miles and analyzed, the proportion of helium has proved to be about the same as at lower levels; at extremely high altitudes, such as 100 miles or more, the proportion may, however, be much increased. Helium is also found in very minute quantities in sea and river water; undoubtedly it

exists in some of the fixed stars, as well as in the sun, and its presence has been spectroscopically determined in many nebulae. Helium is found in the gases evolved from many mineral springs; some contain a high percentage of helium, notably the gas from mineral springs at Mazieres, France, which has over 5 per cent of helium, and two springs at Santenay, France, with more than 8 per cent. But the total amount of these gases is relatively too small for extraction of helium from them to be feasible for practical uses. Helium is found also in some volcanic and fumarole gases, such as the steam issuing from the boracic acid fumaroles of Ladarello, Italy, which contains a small percentage; and in many rocks and minerals, being almost always associated with those of radioactive character. All thorium and uranium minerals contain helium in appreciable quantities; the gas can be obtained by heating the mineral strongly in a vacuum, or by dissolving it in acid. Some radioactive minerals yield from one to five cubic centimeters of helium per gram.

In 1907, Cady and McFarland, of the University of Kansas published a report on the presence of helium in several natural gases, mainly Kansas gases. Some of the samples tested ran as high as $1\frac{1}{2}$ per cent of helium by volume. This work of Cady and McFarland disclosed the information necessary for the inauguration of the helium "project" during the war.

To date no one has succeeded in combining helium with any other element, or in inducing the gas to take part in any chemical reaction under any conditions. In this respect, it is similar to other rare gases of the atmosphere—neon, argon, krypton, and xenon. Helium is only slightly soluble in water. Its thermal conductivity is fairly high, but it is less than that of hydrogen. A volume of helium weighs about twice as much as an equal volume of hydrogen, under identical conditions of temperature and pressure. It is a good conductor of electricity, being next to neon in this respect. Under similar conditions it conducts a current 25 times as readily as air. After overcoming immense difficulties, Professor Kammerlingh Onnes, of the University of Leyden, in 1908, succeeded in liquefying helium. The liquid boils at -268.75° centigrade or $4\frac{3}{4}^\circ$ absolute. Solid helium has not yet been obtained.

Before the World War, the Germans had developed a type of dirig-

ible called Zeppelin, after Count Zeppelin, its inventor. In the early stages of the war, the Germans used dirigibles largely for bombing, particularly over London and the munitions district of England. Though minimized as long as the war was in progress, the damage done was great. Another use for dirigibles, recognized by military and naval men as probably more important than bombing is scouting. The German fleet never ventured from port without two or three scouting dirigibles which at all times informed the fleet below of the near approach of British war vessels. The German fleet could then accept battle, or retire to its base.

The French and British had no dirigibles at the beginning of the war, but later hastened to repair their deficiency. From experience gained in the defense of London and other important points, it was recognized that the dirigible was vulnerable—extremely so, against a well-organized attack. The Germans too recognized this and invariably made attacks on England at night, operating from a high altitude in order to minimize attacks by aeroplane, as a single incendiary bullet fired into a dirigible would quickly bring the huge ship down, a mass of flames. The inflammability of the hydrogen contained in the ship was the one weak point in this method of attack. The constant danger of a swift and terrible death had its effect moreover on the nerves of operating crews, lessening their efficiency. The remedy for this situation was, of course, to be found in a non-inflammable gas, light enough to replace hydrogen as a lifting force; helium is the only gas known to have these qualities. The use of helium has still other advantages: It diffuses through a fabric at about three-quarters the rate of hydrogen; its non-inflammability makes it possible to place the engines in the framework of the dirigible, thus getting a direct drive, giving greater control of the craft, and much increased speed for any given horsepower.

Early in 1915, word came to an official of the Bureau of Mines that the British were interested in sources of helium for use in dirigibles. When the United States entered the war in 1917, helium for use in dirigibles was discussed among Bureau of Mines' officials, and in June the matter was presented to the Army and Navy Air Services as a war project. These services enthusiastically approved the proposition, and allotments of money were made from the Army and Navy

appropriations to carry it forward.

Three experimental plants were constructed in Texas, under the direction of the Bureau of Mines, two at Fort Worth, for economic reasons; one plant used the Linde system of liquefaction, the other the Claude system, and the supply of gas was piped to the plants from Petrolia, Texas. Analysis had showed that this gas contained .95% helium. Another plant was later constructed at Petrolia, near the gas wells, and use was made of a new method of liquefaction, called the Jefferies-Norton process. All three plants produced helium, but the Linde plant proved the most efficient, and it was decided to construct, under the cognizance of the Navy, a much enlarged plant for obtaining helium in greater quantities. The construction of this plant was started in October, 1918; it was completed in December, 1920, and was operated during part of 1921. It produced altogether about 2,000,000 cubic feet of helium, which, with the helium obtained at the smaller plants during the experimental period, makes available at the present time a total of about 2,400,000 cubic feet of helium over 90% in purity. Most of the gas is around 95% grade.

Before the completion of the large plant, the two experimental plants at Fort Worth were shut down and dismantled. The plant at Petrolia, Texas, was continued, however, until July, 1921, on a purely experimental basis. It was then shut down, and at the present time is being kept in a standby condition.

The method of operation in all of these plants is, in general, the same,

although there is considerable difference in detail. The object is to liquefy all of the elements making up the natural gas except the helium, which does not liquefy at the temperature used. After liquefaction of all other constituents in the gas—such as nitrogen, methane, ethane, propane, and butane—the helium can be pumped off. Thus far, helium has been obtained in two stages. One stage in operation gives about 70% purity; this has been refined up to 95%. In the second operation the nitrogen, representing practically all the impurity, is liquefied and the helium is once more pumped off.

No production of helium is now in progress, but funds will probably be furnished by Congress to run the large plant at Fort Worth practically during the whole of next year. Under such conditions, from eight to ten million cubic feet of helium may be obtained.

Two helium repurification plants have been constructed by the Army, and the Bureau of Mines is cooperating in installing the final liquefaction equipment. One of these is at Langley Field, Va. In this is used an expansion engine refrigeration system, with heat interchanges, and an especially designed purifier. This plant will be used for refining helium after it has been used in a balloon or dirigible and has become contaminated with air by interchange through the fabric. When the grade of the gas is reduced to 85%, its lifting power (which is normally 92% that of hydrogen when both gases are 100% pure) is too low for practical use, and the gas must be refined.

After being refined, it can be used again.

The other repurification unit has been installed on two railroad cars. One car contains the power plant, and the other the compressors and liquefaction equipment. These can be moved from place to place as needed. The use of charcoal at low temperatures for repurification will be tried in this plant. Charcoal exercises selective action in absorbing air and nitrogen, taking them up freely, whereas helium is scarcely absorbed at all. In this way a separation of helium can be obtained.

Complete equipment for conducting research at low temperatures, the Cryogenic Laboratory of the Bureau of Mines, is located at Washington in the Interior Department building, representing the research department of the whole helium project, and employing a force of 12 men. Fundamental information is being obtained that is essential for the construction of any new plant designed to have greater efficiency than the large plant at Fort Worth. Helium can probably be produced in this plant for 10c a cubic foot, but it is believed that the cost can, ultimately, be reduced to 3c and perhaps to 2c. Necessary information is being gradually accumulated to this end.

The Government's entire helium program is now carried on under the general authority of the Army and Navy Helium Board, consisting of a representative, each, of the Army and Navy, together with a delegate from the Bureau of Mines.—Reports of Investigations, U. S. Bureau of Mines.

New Navy Seaplane Engine

A MARKED feature of aeronautical engine development in this country is the encouragement by the Bureau of Aeronautics, Navy Department, of independent development of aircraft engines for the prospective requirements of naval flying.

An interesting result of this encouragement, is the development by the Wright Aeronautical Corporation, of a new 12-cylinder engine, known as Model "T-2." This engine was designed to meet the Navy Department requirements, and has been built on Navy Department orders. It is designed for heavy duty service on planes, whose long flights require great durability, and on account of the weight of gasoline necessary, the engine had to be economical as possible. Notwithstanding these primary considerations, this engine, as

developed, seems to have a wide range of application, owing to its low weight per horsepower.

Some of the "T-2's" mechanical features are believed to be entirely new. These include a form of crankcase, in which the crankshaft is held in the upper case by bearing caps, rather than by the upper and lower halves together; a form of can box, which not only carries the camshafts and rocker arms, but also forms a truss at the top of the cylinders. Integral with each cam box is an intake manifold, so designed that the carburetors may be placed either below the crankcase or in the V. An open end cylinder sleeve construction and the use of aluminum bronze valve seats are also new features. Referring to the photographs, we note that the cylinders are cast of aluminum in four blocks of three, and that

a single cam box covers the six cylinders of each bank. In order to give the reader an idea of the size of this engine, it should be noted that it is slightly shorter than the Liberty, and fits into the same bed timbers. The details of the engine itself are as follows:

Bore, 5¾ ins.

Stroke, 6½ ins.

Piston Displacement 1947 cu. ins.
Rated H. P., 525 at 1800 R.P.M.

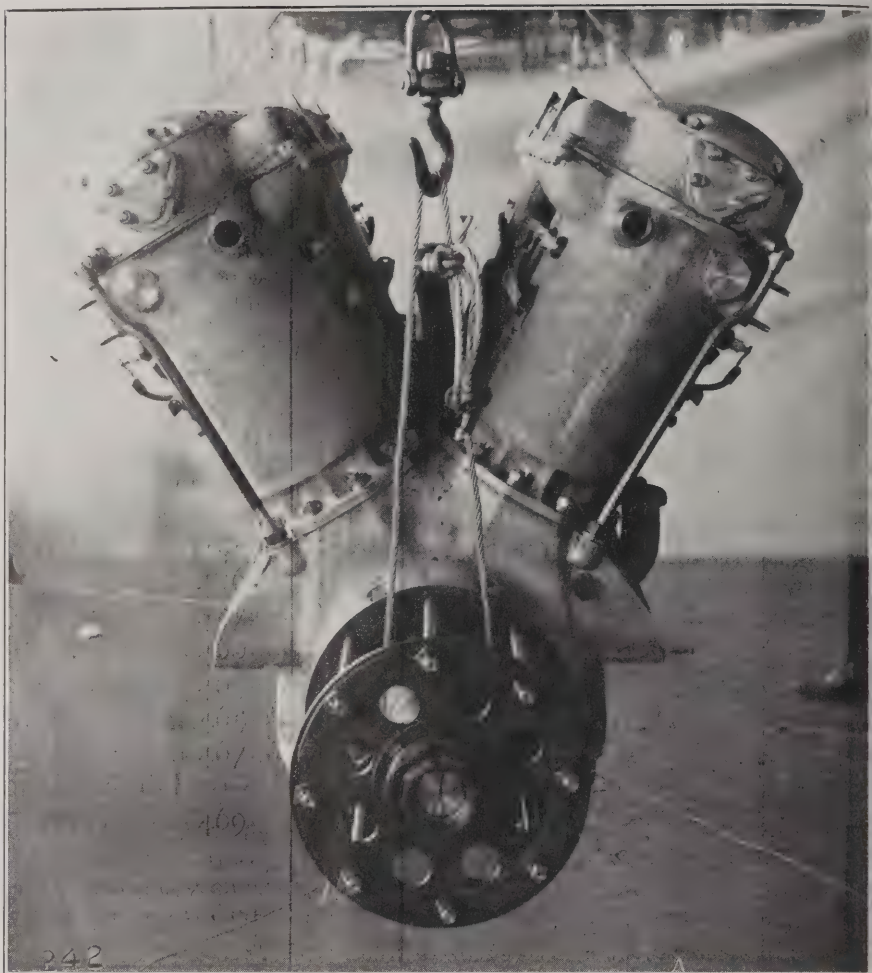
The engine is purposely somewhat throttled, in order to increase its ability to run for long periods, without decrease of power, and with a very low fuel consumption.

One of the interesting details of the engine is the cylinder construction. This permits of an aluminum combustion chamber in direct contact with the cooling water. A removable wearing surface is provided for the

piston by the use of an open and steel sleeve, which is shrunk into the aluminum cylinder casting. The valves and spark plug bushings are seated in aluminum bronze rings shrunk into the cylinder heads. This construction provides for adequate cooling for both these important parts, and is considerably different from that used in the standard Wright engines heretofore, in which closed and steel cylinder sleeves were used. Four valves are used per cylinder. The valves are inclined at a small angle, and are actuated by rocker arms directly from a single camshaft housed in each cam box mentioned above. These rocker arms are carried on light steel tubes running parallel with the camshafts, which can be withdrawn from the end of the cam box, thus permitting the removal of the rocker arms. The lubrication of all of the valve-operating mechanism is effected by oil carried under pressure in the rocker arm tubes. Overflow pipes are provided to return the oil to the crankcase.

Valve adjustment is taken care of by adjustment screws on the rocker arms, and in order to facilitate this adjustment the cam box has a light two-part top, which can be easily removed, enabling a mechanic to adjust all valves and inspect the rocker arms, camshafts, bearings, etc. The design of the pistons present no radical features. Three compression rings above the pin and a scraper ring on the skirt are used. The floating type of piston pin, with bronze retaining plugs, is provided. The inner and outer connecting rods have a tubular cross section, the outer rod being forked to hold a new type of connecting rod bearing. This bearing is a split sleeve and is made of a new material, which does not require a babbitt facing. The inner connecting rod bears directly on the outside of this bearing, and the bearing itself bears on the crankpin. The crankshaft is exceptionally robust, having 3-inch diameter main and crankpin bearings. Seven main bearings are used, the center and front bearings being very long. The propeller thrust is taken by a deep row radial bearing. The propeller end of the shaft is interesting, as it embodies a new design of hub fastening. The shaft itself is splined with 17 splines. The drive is through the splines from the crankshaft to the propeller hub. The hub is centralized by a pair of tapered cones, one at each end of the splines.

Details of the crankcase are most interesting, as the design, which was first used in the Wright dirigible engine, provides an exceedingly neat and stiff girder for carrying the en-



Wright Seaplane Engine Model T-2

gine stresses. The method of construction might almost be called a one-piece crankcase, as the lower portion is only a bottom pan containing the sump and carrying the oil and water pumps. The main bearings are, as before stated, held in place by bearing caps. This method of construction makes it perfectly possible to remove the under pan, which contains no mechanism for which any readjustment is required, and thus inspect the main and the connecting rod bearings without removing the engine from the aeroplane.

The drives for the magnetos, camshafts, oil and water pumps, as well as the synchronizers, have been laid out with a special reference to accessibility and ease of adjustment. Not only are these drives arranged in a flat, compact form, as will be seen from the illustrations, but provision is made for a generator or fuel pump drive in the Vee, and a hand or electric starter, or other auxiliary, at the rear of the engine. Water is carried to the lower side of each bank of cylinders through suitable piping from the pump, and is taken out at the propeller end of each cylinder bank. The oil passes from the pressure pump through a large cylindri-

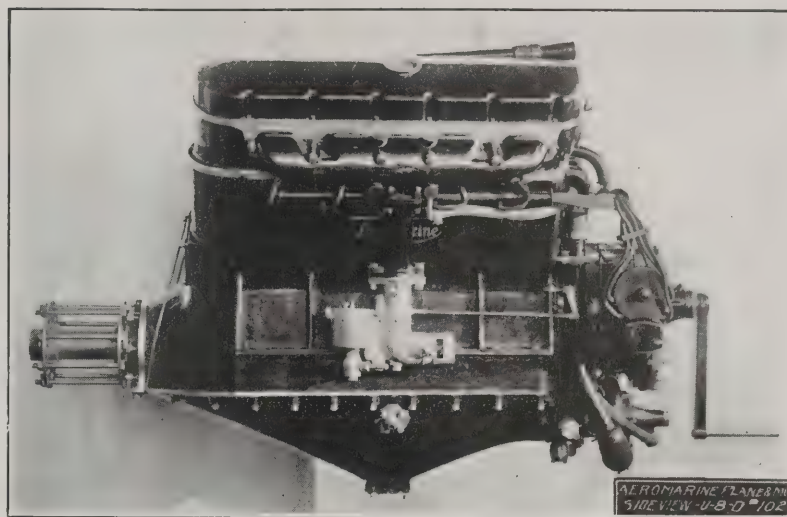
cal strainer, and is fed to all parts of the engine under a pressure of 7 lbs. per sq. in., the only parts lubricated by splash being the pistons and wrist pins.

The ignition is by two SS-12 Splendor magnetos, one magneto firing all the inside plugs, and one the outside. Two separate carburetors, as seen in the illustration, are of the latest Stromberg aviation type. The engine, in accordance with the Navy Department's requirements, was built to run on standard domestic aviation gasoline. Furthermore, all parts, including spark plugs, crankcase bolts and oil strainer, are so placed as to be readily accessible and easily disassembled in the aeroplane.

The Model "T-2" engine, above described, has recently been accepted by the Navy Department, after an official 50-hour test, in which the engine developed an average of 500 h.p. at 1800 r.p.m. During this test the average fuel consumption was .02 lbs. per b.h.p. hr.

Aeromarine Aircraft Engine Sets World's Record In Endurance Test

THE Navy Department, Bureau of Aeronautics, have inaugurated new test conditions for aircraft engines which mark a new step in aviation development. In the past it has been the rule to prove new types of engines by a fifty-hour endurance test, run in five-hour periods. This test has generally been regarded as one of extreme severity and the few types that have successfully completed this period without major failures have been considered to have entirely proved their suitability for aircraft use. Realizing that the next step in aeronautics is the development of engines of greater durability, the bureau has increased the length of their tests to six times the old standard, or three hundred hours. This ultimate limit was set in the expectation that any existing engine would have been run to destruction before that length of time, so that the actual life could be determined. The test, however, failed in its intention in the case of the Aeromarine U-8-D, which is still pulling its full horsepower and functioning perfectly in all respects at the end of the three hundred hours. Several engines have attempted this test, but as yet only the



Side view Aeromarine U-8-D engine

Aeromarine U-8-D has successfully completed the entire three hundred hours.

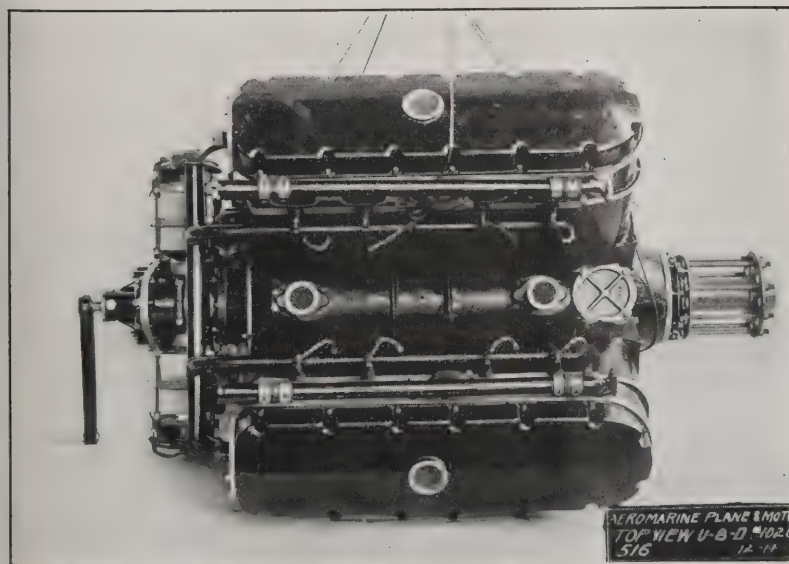
The test is run in three main periods of one hundred hours, each including eighty-six hours at flying load, followed by fourteen hours at full throttle. After each hundred hours the engine was put through a complete series of tests to check up horsepower, fuel consumption, etc., and was subjected to detail examinations for wear. These tests were ob-

served and all records checked and certified by Navy Inspectors working in three eight-hour shifts—to get in three hundred hours, working the standard forty-four hour week, would have taken almost seven weeks.

The following facts are of interest and help towards a realization of the arduous conditions to which a test of this kind subjects the engine:

Each of the pistons as it reverses its direction of travel at the end of each stroke is brought to a stop, while at the middle of the stroke it is travelling at a rate of 38 miles an hour at 1700 revolutions per minute, rated engine speed. That is to say, in 1/112 of a second the piston speed is brought from zero to 38 miles an hour and is brought to zero again in the next 1/112 of a second. Each of the eight pistons continued these 112 accelerations per second for three hundred hours or 120,000,000 times. The explosion load on each piston is in excess of four tons and one hundred explosions occur per second.

The average horsepower developed was 175, which is sufficient to propel a five-passenger aeroplane at a speed of about eighty miles an hour and in the time of the test such a plane would have flown completely around the world.



Top view Aeromarine U-8-D engine

The total amount of work done by the engine is equivalent to lifting a weight of one ton to a height of 1,270 miles.

Sixteen tons or 5,300 gallons of gasoline were used in this test.

The equivalent gasoline consumption in the plane would have been four and three-quarter miles per gallon. The average oil consumption was .0086.

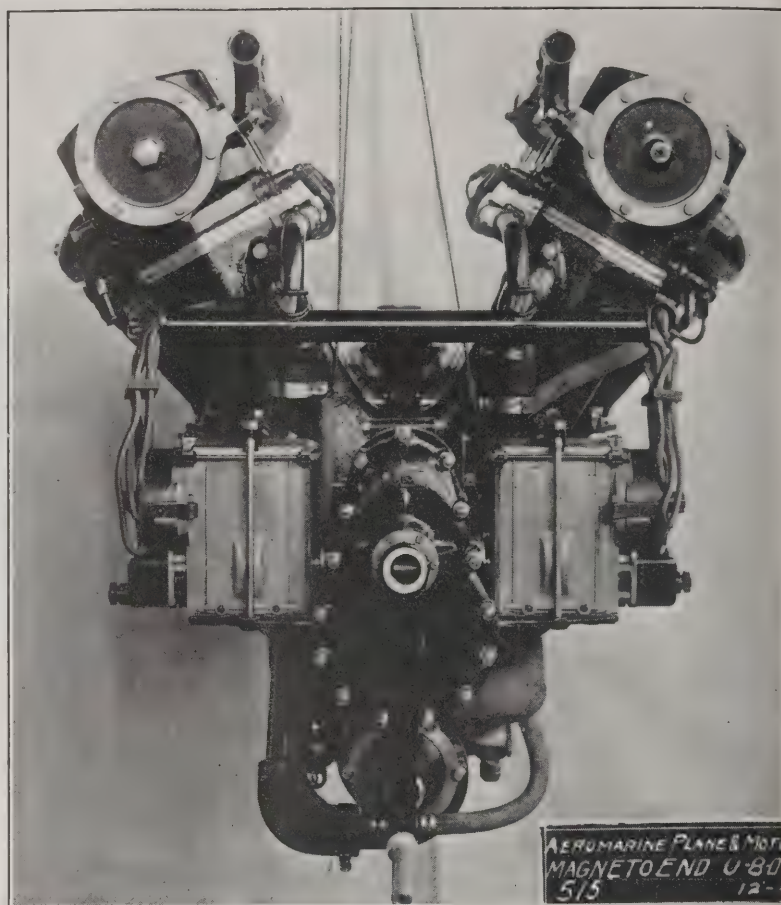
The tip of the propeller used on this test travelled 91,200 miles or almost one-third of the distance from the earth to the moon.

During the test the engine made over 31,000,000 revolutions and almost 9,000,000 revolutions between stops. As a comparison it may be stated that the ocean liners average about one-half million revolutions of the engines on the trip from Liverpool to New York.

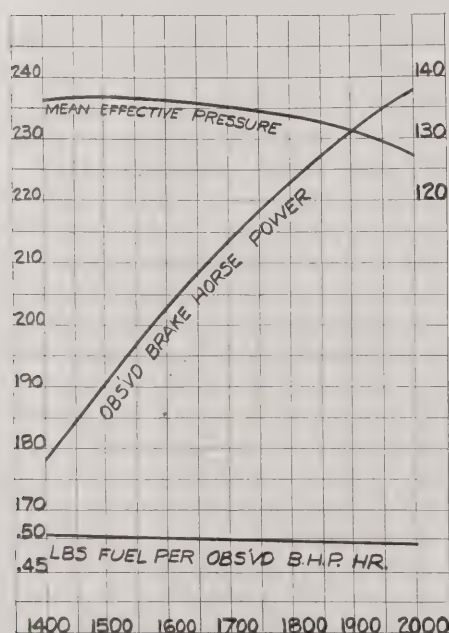
During the test the pump on the engine circulated 2,726 tons of water.

The long valve life demonstrated in the test was deliberately aimed at, and very special attention was given to the valve seat and guide. The seat is cast into the head, which gives better thermal contact than any other known method of uniting two pieces.

The connecting rod bearings on the U-8-D have the same area as the 400 H.P. Liberty Engine, while the crankshaft bearings are considerably larger. Very special precautions are



Anti-propeller end view Aeromarine U-8-D engine



Power curve of Aeromarine U-8-D engine after completing 300-hour test

taken to insure extreme rigidity in the bearing shells and there is incorporated in the oil system mechanical means for trapping all the dirt in the oil before this reaches the bearings. This has resulted in exceptional bearing life.

The cylinder sleeves, which are removable for replacement, are in direct contact with the cooling water. These provisions together with the carefully developed water circulating system which concentrates the flow at the points where most needed, make the U-8-D Engine particularly insensible to water temperature conditions.

In order to keep vibration to a minimum the angle between the cylinders on the Aeromarine is made 60°. The 60° design gives a constant rotating out-of-balance force of exactly one-half the magnitude of the unbalance in a corresponding 90° engine.

The detachable head construction of the Aeromarine affords ideal accessibility for the complete valve mechanism. Heads can be changed in

a few minutes, by which means complete tope overhaul of the entire valve mechanism is effected, when necessary adjustments are made on the bench. The Aeromarine design affords quickly detachable and interchangeable cylinder sleeves.

For future production, modifications are being made to this engine whereby the weight is being very materially reduced on those parts which do not affect the life of the engine. At the same time the bore is being increased so that Type U-873 will be rated at 250 H.P. and in the high compression type will develop upwards of 275 H.P. The weight is 520 lbs., giving a weight factor of 1.3 lbs. per H.P. in this U-873 Type. This weight reduction is being achieved in spite of the fact that all parts which showed less than 100% perfect at the end of the 300 hours in the test are being strengthened or otherwise modified to bring them beyond the 300-hour standard.

The M. I. T. Soaring Machine

By Frank M. Gentry

Member Managing Board Aero. Eng. Soc. of Mass. Inst. of Tech.

BEFORE the advent of the aeroplane, the attention of the public had been directed in part to the experiments of Chanute, Lilienthal, and Montgomery, whose performances in heavier-than-air contrivances furnished a substantial background for the present development in the art of flying. With what now appear to have been crude assemblages of wood and fabric, they actually succeeded in making short flights, or more properly, perhaps, *air-slides*, which in those pre-modern days of aviation was a noteworthy accomplishment.

Of no less importance were the early experiments of the Wrights at Kitty Hawk, N. C., which resulted in the installation of the first power unit. Once the machine was constructed, gliding was simplicity itself. It merely involved utilizing gravitation and the opposing air pressure to produce translatory motion. In other words, gliding amounted to nothing more than sliding down an inclined plane of air along the path of least resistance under the influence of gravity. Birds had been observed to glide, but more than that, they had been observed to *soar*—rise, gain altitude, without the slightest effort on their part to furnish the propelling force. Their native instinct enabled them to sense and use to great advantage the stored energy of air currents and wind puffs. But Nature was not longer to keep her secret from man when Orville Wright in 1911 demonstrated by remaining aloft nine minutes and fifty-four seconds that a heavier-than-air machine could be sustained by the notion of the winds.

This was the first step in soaring light, but there the matter stood, al-

most forgotten, for nine years. The great strides in aircraft development and later the Great War thrust it into obscurity until revived by the enthusiasts in Germany after the wings of the Central Powers had been clipped by the Versailles Treaty. Thus arose the new art of utilizing the wind currents in sustained flight.

Motorless flight includes both soaring and gliding flight. Gliding is always the outcome of soaring; the machine soars with every available wind to gain altitude and then glides toward its destination. Granting the existence of the proper currents, soaring depends primarily upon the skill of the pilot and secondarily upon the maneuverability of the plane. This

the Massachusetts Institute of Technology was one of the first to become interested in the introduction of soaring flight into the United States.

Early in January, after much preliminary discussion on the part of the members most interested, a committee was appointed to make plans and direct the construction of a soaring plane. The two most serious problems confronting the committee were the questions of finance and man-hours. The necessary funds were finally secured by popular subscription among the society membership. A questionnaire was submitted in which each member was asked to fill in the number of man-hours that could be expected from him. With



The M. I. T. Soaring Glider

last consideration imposes special requirements in design.

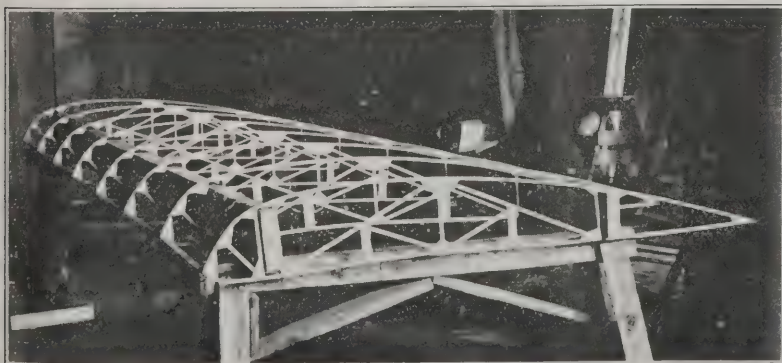
Little need be said of the performances of the Aachen, Harth, Hannover, and von Lossel machines in the Rhoen Valley, as much has already been published, but they may be referred to later for comparative purposes.

The awakening in America naturally followed the rapid spread of enthusiasm throughout Europe. The Aeronautical Engineering Society of

these obstacles successfully surmounted, the committee announced a competition for designs. Out of some five designs received, the judges, Prof. E. P. Warner of the department of Aeronautics acting as chairman, declared Mr. C. T. Allen and Mr. O. C. Koppen winners of the competition.

The original plans were slightly modified to give larger control surfaces and to facilitate ease in construction. The available labor being limited in time and skill, simplicity of construction was one of the deciding factors in the design competition. No variable wing section was attempted. Although the initial plans called for a streamlined fuselage, careful analysis seemed to indicate that the results would not warrant the decreased visibility for the pilot or the attendant structural complications.

The usual stress analysis was made so that the factor of safety would not fall below six. Duplicate pieces were made of the important parts of the machine and tested for their breaking strength in the Testing Materials Laboratory of the Institute. For the most part it was found that the break-



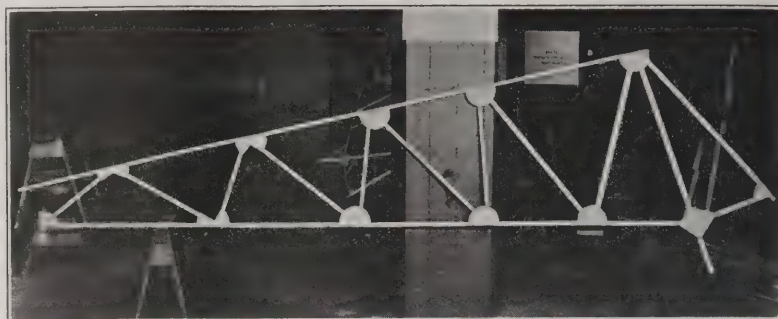
Construction of Central Wing Section

ing strength far exceeded the required values.

The Technology soaring plane is of cantilever construction. It has a hundred and twenty square feet of supporting surface and tips the scales at a fraction less than seventy-three pounds. While every effort was made to lessen the weight without reducing the strength by the efficient use of materials, its lightness exceeded the expectations. Allowing a hundred and thirty pounds as the weight of the pilot, this gives a flying load of one and seven-tenths pounds per square foot. This is about the carrying capacity of the condor and is slightly greater than the loading of the principal successful foreign soaring machines. The wing has a spread of twenty-four feet, a chord of four feet, nine inches and an aspect ratio of five.

A Martin No. 2 wing section was selected as the most suitable for the conditions of soaring flight. The ribs have a maximum depth of seven and one-half inches and weigh four and one-half ounces each. Under actual test, this rib withstood a distributed load of one hundred and ninety-eight pounds before shattering. It is designed to carry a load of sixty pounds, allowing a factor of safety of six. All the ribs are identical except the end ribs which have a depth of two and one-half inches and are cut from ply-wood. The ribs are constructed of spruce with ply-wood gusset plates, glued and tacked at the joints. Their carrying capacity of forty-five pounds per ounce of weight is somewhat remarkable.

The wing is made in three sections to permit ease in transportation. The central section is twelve feet long while the end sections are six feet. The wing spars are of the conventional box type construction of three-quarter inch spruce cap-strips and sides of three-ply ply-wood. The elements are glued and screwed. Two wing spars are provided and, while they are not identical, their depth was made as great as the wing section would permit in order to obtain maximum rigidity. The spars of the central section are tapered in the horizontal plane while those of the end sections are tapered in the vertical plane. The entire wing can be quickly assembled and made secure by means of eight steel bolts in thin sheet steel fittings. When tested, one of these fittings withstood five thousand, two hundred inch-pounds before the supporting frame broke and the rest of the test was abandoned. The internal bracing consists of diagonal guys and light compression members at the ends of the sections. The



One of the fuselage trusses

former are of piano wire made taut by means of turnbuckles made from bicycle spokes. The ribs are braced by interwoven tape strips. A balloon cloth weighing one and nine-tenths ounces per square yard forms the covering. Two coats of a special glider dope were applied. The wing has no dihedral, thus permitting greater ease and strength in construction.

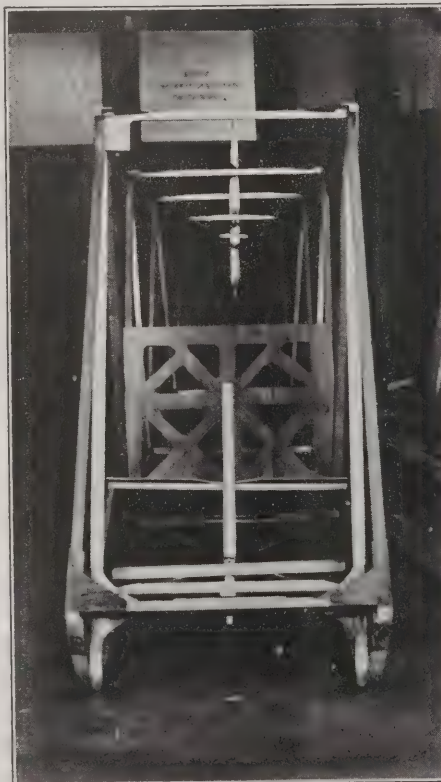
The fuselage is of the customary rectangular section, tapering to the rudder post at the rear. For the most part, it is constructed of spruce, although the front members are of ash to add greater strength near the landing gear and pilot's seat.

The joints are made with 3/32 inch ply-wood gusset plates glued and screwed. Under test, a sample joint broke at five hundred and sixty pounds. Each fuselage truss is ten feet long, twenty inches high and

weighs four and one-half pounds. The wing is fastened to the fuselage by means of four steel fittings which were found to have a breaking strength of eleven thousand pounds. Little labor is involved in detaching the wing for transportation. A noticeable feature is the absence of external wires, none being present except those necessary for the manipulation of the controls.

The machine is equipped with the usual number of control surfaces. Comparatively large surfaces were used to obtain greater maneuverability. The stabilizer has a span of seven and one-half feet and a width of one foot, nine inches, giving an area of thirteen square feet. Each elevator is hinged to the stabilizer with three light hinges. The elevators are three feet, nine inches long by one foot, seven inches wide. The rudder is approximately twenty-nine by nineteen inches. A slightly smaller rudder was submitted to a sand loading test. The glue under the horn was not dry when the test was made and consequently came loose under a load of eleven and one-half pounds per square foot. The other parts of the rudder showed no signs of breaking. The horns are cut from ply-wood the holes for the control wires being reinforced with metals washers to prevent wear. The ailerons are six feet long, extending the entire length of the end sections. They have a width of one foot, four inches. A bell-crank control system is used for the ailerons to eliminate the danger of pulleys. A stick and rudder bar are used to manipulate the controls.

The pilot's seat is cut from ply-wood and is located over the rear portion of the landing gear. Two skids, formed from strips of ash and fastened to the lower longerons, form the front landing device. No shock-absorbing mechanism is provided other than the spring of the skid itself. The tail skid is also built up from ash strips but it is provided with a rubber shock-absorber.



Front view of fuselage

Organizing a Successful Meet

By W. W. Wyman, Mgr., Aeronautical Dept., C. L. Maguire Petroleum Co.

IT is my privilege to attend flying meets in many parts of the country, and I feel it will be a service to aeronautics to tell of the preparation and organization of the most successful meet—the one put on by the whole city of Monmouth, Illinois, June 15th to 17th. The population of Monmouth is only 10,000.

About a year ago the Exchange Club of Monmouth, a newly organized luncheon club, composed almost entirely of young business men, decided that they must do something to arouse the progressive spirit of their city. A committee was appointed and after due consideration reported on three plans to accomplish the desired results. They were: (1) An Aviation Field with an annual meet; (2) A City Layout Plan; (3) City Playgrounds.

A fine field was secured one mile from the center of the city, which was leased to the Curtiss-Iowa Aircraft Corporation of Des Moines, Iowa, under contract to equip, operate and maintain a first-class flying field.

The Monmouth Aero Club was then organized with a very large charter membership, who immediately started to work as a unit to put on a successful meet. They first secured the advice and counsel of such able men as Major R. W. Schroeder, in charge of the Aeronautical Department of the Underwriters' Laboratories, Inc., and Morrow Krum, aviation editor of the *Chicago Tribune*.

The Curtiss-Iowa Aircraft Corporation took immediate possession of the new flying field, erected a hangar and started operations. The field rapidly gained publicity through several trips to Chicago, strongly featured by Morrow Krum in the *Chicago Tribune*, and many cross-country passenger-carrying trips.

The dates of the meet were set many months in advance and decision made regarding contests and events. The leading merchants, manufacturers and associations were induced to donate a total of nine beautiful silver cups as prizes for the leading events. 75,000 little red stickers, announcing the meet, were purchased and one was pasted on every letter that went out of the city. A supply was given to every traveling man who traveled out of or visited the city, and they plastered them all over Illinois, Iowa and Wisconsin. 2,500 window cards were printed and placed in all stores within a radius of fifty miles. A little folder was prepared, listing the attractions, events and expected visi-

tors, and mailed to Chambers of Commerce, Aero Clubs and operators of aeroplanes. 50,000 schedules of the Chicago-Monmouth Air Route, in operation by the Curtiss-Iowa Aircraft Corporation, were distributed by mail and planes, and then a few days before the meet 25,000 dodgers were distributed by plane over the surrounding cities and towns. In addition to this they advertised in several newspapers in nearby cities, and the Monmouth newspapers, with about 6,500 circulation, ran page after page of free press notices and advertisements.

To quote from a letter from Mr. C. W. Buchanan, president of the Monmouth Aero Club: "We put one man of exceptional executive ability in complete charge as General Chairman to direct all the affairs of the meet, and he in turn appointed his chairmen and assigned to them the various tasks to make up the meet as a whole, and made each responsible for his particular task. This was one of the main contributors to our success.

"We secured the active support of each city and county official and now realize that this support was an essential to success.

"As we had arranged no second prizes we decided to extend the hospitality of the city in entertaining our visitors and guests. On arrival each visitor and guest, including mechanics, was given a card which entitled him to gasoline, oil, meals, hotel bills, use of Y. M. C. A. swimming pools and full privileges at the Country Club, absolutely free of charge.

"One item which contributed largely to our success was the fine manner in which our traffic was handled, with the result that there were no accidents to cars or pedestrians. This was handled entirely by our local army units, who policed all roads to perfection.

"The road passing the field was confined to one-way traffic and no parking was allowed on any road near the field, though ample parking space was available within the field. This would have been impossible without the co-operation of the county officials.

"Neither were there any accidents to flyers or their ships, due to the able management of Major Schroeder, who had charge of all flying.

"We sold over 3000 advance admission tickets and secured enough rain insurance for the first day to cover our expenses.

"It was a pleasure to see the gov-

ernment pilots ask for service for their ships, then as an afterthought ask what oil and gas we were using, and when they were told it was Lakeside Aviation Oil and Standard's Air Service specification gasoline, to see how well pleased they were and how soon their worry over these items disappeared. Many remarked that we were surely giving away the best obtainable."

There were over 10,000 paid admissions to this three-day meet, which is certainly remarkable for a city of only 10,000 population. These admissions paid all expenses and left a substantial profit. It just shows the real fundamental cause of the financial as well as the operating success of this meet. The whole city, to a man, pulled together as one team with one big idea—a successful flying meet. There were no petty jealousies, no holding back, no pessimists. Everyone, no matter what his position, did what he could to help. Anyone could have asked the Mayor to run a necessary errand and he would have done it without letting it be known that he was the Mayor. Every visitor, whether high army official or mechanic, was treated as if he were the guest of honor. The ones who could take no active part in the planning or organization did take a very active part in making it a success by coming to the meet and paying their admissions. One day of the meet was declared a holiday in the whole city. It was this spirit of unselfish willingness to serve, this spirit of unselfish hospitality, this spirit of united effort that made this meet such a success. And these same qualities displayed by any city or town, no matter what its size, will make it possible for them to run a successful meet. Visitors to the Monmouth Meet will long remember it as the brightest spot in their whole season's work.

Monmouth, Illinois, is destined to be well known in aviation circles, mainly because of its unity of interest in aviation and because of its geographic advantages. It has excellent railroad facilities. It is located about half way, or one-hop distance, in a nearly straight line between six large cities, namely, Chicago and Kansas City, Minneapolis and St. Louis, Omaha and Indianapolis, and very little out of line between Chicago and Omaha. This will make Monmouth the logical stopping place for the air traffic that will some day in the near future operate between all these large cities of the Middle West.

The Aeronautical Situation in Germany

By William Knight, M. E.

SINCE the end of the war (and before) aeronautical interests in Europe both political and commercial, have been looking upon Germany and the development of German aeronautical activities with a great deal of nervousness.

Germany during the war and since the war stopped has made such substantial progress in aeronautics, that the preoccupation of the rest of the world in its progress is quite justified.

The hesitancy and the lack of a well-defined understanding on the matter of aeronautical policies of the allied nations towards Germany has been the outstanding feature of all the governmental conferences which from time to time have taken place among the allies on the matter of future aeronautical developments in Germany.

A short survey of what the allies have tried to do from the time the armistice was signed up to the present time in order to keep the German flag out of the air and the actual results obtained in this direction will probably be illuminating to all those who are interested in the international aspect of aeronautics.

After the armistice Germany delivered to the allies 1,700 aircraft and the peace treaty signed at Versailles on June 28th, 1919, imposed a number of limitations upon German aeronautical activities and reserved a number of rights and privileges to the allies in connection with civil aviation developments in Germany.

Art. 201 of Section V of the Peace Treaty grants to Germany the right to resume aeronautical construction six months after the ratification of the Peace Treaty, namely: July 10th, 1921. Art. 202 imposes the destruction or the delivery to the allies of all military aircraft and aeronautical equipment.

Art. 313-320 of section XI of the Peace Treaty reserves to aircraft of allied nations up to January 1st, 1923, the right to fly over German territory and to participate in the air traffic in Germany under the same rights and obligations as German aircraft.

On June 20th, 1920, it was decided at the Boulogne interallied conference that Germany was not complying with Art. 202 and in order to make it comply with it, the German Government was notified that the provision of the Peace Treaty regulating aeronautical construction in Germany was amended to the effect that Germany could not resume aero-

nautical constructions before three months had elapsed from the date when the interallied aeronautical control commission would report that the provisions contained in Art. 202 of the Peace Treaty had been complied with.

On July 10th, 1920, Germany, ignoring the decisions taken by the allies at Boulogne, resumed aeronautical construction and the allies found themselves compelled to include in the protocol drawn up at Spa on July 12th, 1920, the decisions taken at Boulogne.

On January 20th, 1921, the allies requested Germany to accept a distinction formulated by them between civil and military aircraft and set May 15th, 1921, as the final limit for complying with Art. 202 as mentioned above. After an ultimatum was sent to Germany on May 5th, 1921, the German Government accepted on May 11th, 1921, the request made by the allies on January 29th.

On November 16th, 1921, 250 new aircraft built since the armistice, in opposition to the conditions laid out by the allies in the Peace Treaty and in the subsequent interallied conferences, were either delivered to the allies or were destroyed. On February 1st, 1922, the council of allied ambassadors decreed that on May 5th, 1922, the limitations imposed by the allies upon the construction of aircraft in Germany would be removed.

May 15th, 1922, is the date which will mark in the future the official starting point of German aeronautical activities.

In the meantime, while the allies were exchanging notes among themselves and between themselves and the German Government on German aeronautical activities in the future, German aeronautics was progressing in the scientific research field, in the engineering and the manufacturing field and in the organization of aerial commercial lines.

The allies left to Germany, after the war, about 100 old types military aeroplanes to be used for commercial purposes and with such material, from April 1st to October 31st, 1921, these aircraft flew more than one million miles, transported 6,800 passengers and 31 tons of mail and merchandise and on May 5th, 1922 the total strength of German aviation (including the 100 aeroplanes mentioned above) was 225 aircraft.

Two important groups of aerial operating companies have been

formed in Germany lately and each one of these two groups has been put under the wings of one of the two large shipping interests represented by the Norddeutscher Lloyd and the Hambourg Amerika Linie respectively. The first group is composed by Albatros, Junkers, Sablatniz, Rumpler, Oriental Lloyd, Schütte-Lanz, Benz, etc. The second group is composed by Deutsche Luft Reederei, Danziger Luft Reederei, Deutsch-Russische Luftverkehrs Gesellschaft, Zeppelin Flugzeugbau, Maybach, etc.

Limited in Germany by the Allies, German aeronautical activities have developed abroad. In Italy the Germans are now manufacturing metallic aircraft and a line, Berlin, Roma, Brindisi, Athenes, will be inaugurated in the near future. In the United States the Schütte-Lanz Co. and the General Air Service Corporation, have laid out the basis of a very important aerial service operated with German dirigibles. In Spain the "Zeppelin and American Company" has been incorporated with a capital of 80,000,000 pesetas. In Colombia commercial aerial navigation is operated with a German Company. In Switzerland the "Ad Astro" Swiss Company is subsidized by the German Government (6,500,000 marks in 1922). In Russia the first aerial operating company starting operating there is a German company.

As far as the scientific progress in aeronautics is concerned, we can say that Germany is more advanced in aerodynamical research work than any other country and no other country can boast of having such big men in this line of scientific work as Prof. Prandtl, Prof. von Korman, Dr. Betz and others who have enormously contributed to the progress of aircraft development in Germany and outside of Germany.

It is rather amusing to remember that at the first meeting which took place after the war of the "Société Aérienne" in Paris in which the aeronautical progress in France during the war was reviewed, the lecturers reviewed . . . the progress made by the Göttingen Aeronautical Laboratory under Prof. Brandtl.

As far as metallic construction is concerned I think it is freely admitted by everybody that Germany is leading the world.

The German government is giving direct assistance to the air transport industry by the payment of a subsidy

of 10 marks per kilometer flown for distances under 300 kms., and 11 marks for distances above 300 kms. In addition, in 1921, a sum of 10,000,000 marks was devoted to the relief of aircraft manufacturing companies. The amounts set aside as subsidies for air transports in 1920, 1921 and 1922 are reported to be as follows:

1920, 12,000,000 marks.

1921, 11,000,000 marks (and 1,-

000,000 marks for meteorological services.)

1922, 40,000,000 marks.

I think that from this brief review of cold facts we can draw only one conclusion and the conclusion is that considering that the allies and the United States have not been able to agree on such a drastic policy as would have kept the German flag off the air for ten or fifteen years at least, we have to recognize the fact

that German aviation is a factor to be reckoned with no matter if we like it or not and that the best we can do is to deal with it in the same way as a business concern would deal with a dangerous competitor that cannot be put out of business: to make agreements with him, if possible, on the basis of a reciprocal interest or else to compete with him on the matter of prices and quality.

Navy Changes in Liberty Motor Responsible for Improvement in Navy Plane Operations

ALTERATIONS and changes to the standard Liberty engine, by Navy experts connected with the Bureau of Aeronautics of the Navy Department have been responsible for the vast improvement in operating conditions of Navy planes and have made possible long distance flights without mishap or even so much as the change of a spark plug.

The increased reliability of the Liberty engine has been the subject of report and comment by commanders of Naval Air Squadrons operating with the fleets and letters of commendation have been sent to the officers responsible for the improvement by the Chief of the Bureau of Aeronautics.

The Liberty engine which was brought out in this country during the war was designed to fulfill an urgent need for a standardized aircraft engine that could be placed in quantity production at a time when the air forces of the country were expanded from a negligible quantity to a vast fleet of planes outnumbering that of any country in the world. At the time the Liberty engine had the unqualified support of designers and manufacturers in this country, and it was the best product obtainable in aircraft engines. Foreign critics condemned it in no uncertain terms and on numerous and varied counts. In the light of later experience, it has developed that the Liberty was not as was at first claimed for it the perfect aircraft engine. It had many inherent faults which contributed to unreliability and caused many failures and forced landings. On the other hand the many good qualities of the engine were such as to stimulate every effort to correct existing deficiencies rather than to turn to new design. To this end the Bureau of Aeronautics tackled the problem and by starting with the greatest difficulties and working down

through to minor faults were able by progressive steps to place at the service of the Naval Air Squadrons engines capable of any duty that might be required of it with a maximum of dependability and endurance.

At the time of the Armistice the Navy had some 4,000 Liberty engines representing an outlay of approximately \$16,000,000 of government funds. The engines were subject to unanticipated derangements which necessitated forced landings of frequent occurrence and general overhauls. It will be clear to anyone who has had the least experience with automobile engines that the faults found with the Liberty were such as to cause continuous trouble and derangement.

Among the difficulties experienced were trouble with breaking of timing gears, the oil consumption was excessive, and much trouble was experienced with spark plugs due to their fouling up particularly at low speeds. Cylinder jackets caused considerable trouble from cracking, allowing loss of water which usually resulted in forced landings. Generator failures was another source of trouble and at first it appeared that the inherent design of the Liberty engine was at fault.

The most serious fault encountered was with gear failures and it was to this, that the naval technicians gave first consideration. A re-design of the timing gear was effected and the trouble was completely eliminated. Next the pistons were modified by cutting a groove around the edge of the lower piston ring groove and drilling oil return holes to the inside of the piston. With this change the spark plug troubles were eliminated as it prevented oil from getting into the combustion chamber. It also reduced the oil consumption and as a result of this the oil pressure was raised. With increased oil pressure the bearing life was lengthened and

this lengthened the time between overhauls.

In order to eliminate generator failures a flexible drive was substituted and up to the present time has proved altogether satisfactory in flight test. To overcome cylinder water jacket cracking a re-enforcing strip has been welded across the top of the cylinder on the inside of the water jacket with excellent results.

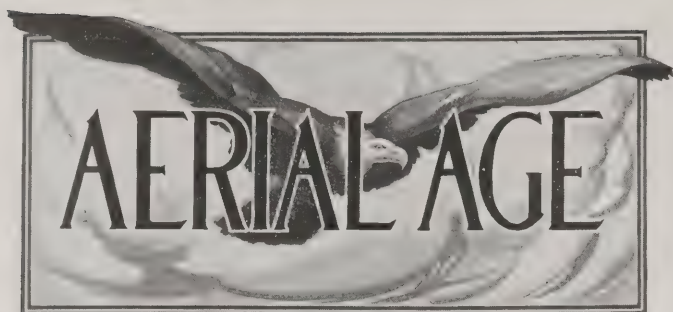
The Liberty engine ignition system had never been entirely satisfactory and recent changes by the Bureau of Aeronautics include the substitution of a twelve-volt ignition system in place of the eight-volt system. This substitution was such that it did not permit the battery to discharge so rapidly. It also allowed much easier starting.

With the above changes in effect the Liberty engine has been in use in planes in the operating squadrons throughout the past winter and spring with excellent results. During the recent ferrying of twelve F-5-L seaplanes from Hampton Roads to Pensacola the performance of the motors reflected the generally excellent results that have been uniformly attained. With the exception of one forced landing due to a leaky water jacket, the engines came through twenty-five hours of flying without the slightest trouble.

In a report to the Bureau of Aeronautics the Commander of the Air Squadrons, Atlantic Fleet, pays high tribute to the work that has been done in this connection:

"In general all the modifications of the standard Liberty have proved of great value," says the report. "The increase in oil pressure has probably doubled the life of the motor." The use of heavy gears has eliminated trouble from this source provided the commanding officers will give their power plants the ordinary care accorded steam power plant machinery.

(Continued on page 478)



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The Detroit Races

AS we go to press over fifty aeroplanes are entered in the National Aeroplane Races to be staged at Detroit from October 7 to 14. There are twenty-three confirmed entries for the Pulitzer Race alone, and it is expected that there will be several others before the list is closed. This contest, with the wide range of types of machines entered, cannot fail to be a classic, and it is to be hoped that the efforts of the Aeronautical Chamber of Commerce will be successful in securing worthy foreign entrants.

The program arranged by the Detroit Aviation Society should have the practical endorsement of everyone interested in aeronautics by their attendance at Selfridge Field from October 7 to 14.

Who Owns the Air?

IN order to assure the future of aerial navigation it may be necessary to carry to the Supreme Court of the United States a case just decided by a justice of the peace in Punxsutawney, Pa.

Over a farm in that euphonious locality flew an aviator utterly disregarding the "No Trespass" signs that were posted upon it for all men to see and take warning.

The flyer, not content with being a mere bird of passage, paused in mid-air to do various hair-raising "stunts," causing the landholder to apprehend that the bird-man might at any minute plunge downward into a grain field or damage a cow beyond repair.

He therefore hastened to the justice's office and secured a summons for the offender, who later was fined the sum of \$1, the justice holding that with the ownership of the land runs the proprietorship of the air, all the way up.

If this is the law no airship can fly beyond the range of its owner's realty without trespassing, unless he secures permission from all the land owners below. If

the Punxsutawney farmer could forbid "stunt" flying he could probably forbid any sort of flying—for the air and all the rights and easements appertaining thereto are his to have and to hold as long as he pays his taxes.

Thus opens a new and interesting transportation problem. It may be necessary in the future for aerial passenger lines to buy franchises across the country, availing themselves of the right of eminent domain and condemning air lanes wherever they need them.

This will be expensive and a great incentive to "honest graft."

Franchises are not easily come by, as anyone knows who is familiar with the history of Tammany Hall. Already the members of that institution must be licking their chops as they gaze at the illimitable ether over New York and think what can be got out of getting options on it before they grant anybody any rights to send aeroplanes through it.

Transcontinental Air Mail

THE establishment of a transcontinental air mail service in 1921 was regarded as an extremely dangerous performance. The amount and variety of territory to be covered between our two coasts are great. Both the Rockies and the Sierras must be crossed, and there are only sixteen federal stations on the way. But the completion of a year of flying without a single fatality indicates that a transcontinental air mail service need not be any more dangerous than a transcontinental motor mail service. The mail-carrying aeroplanes last year flew 1,750,000 miles. That is the same as going around the world seventy times. It might be a sad work counting motor accidents for such a distance.

Taxicabs of the Air

THE taxicab on land has vindicated itself by its convenience, cheapness and service. A somewhat similar system has already been started for air travel abroad. At the Croyden Air Station, near London, an aeroplane taxi, seating three passengers, is maintained ready for immediate flight, the rate being a flat charge of less than fifty cents a mile. A traveler on an eastbound ocean steamship nearing England can call one of these air taxis by wireless and find it waiting his arrival.

We in America are lagging behind Europe in aerial passenger traffic, but when we get our pace the returning American will find a plane cab or his private air car waiting for him on his arrival to whisk him through to his home in New England or wherever else it may be.

THE NEWS of THE MONTH

Air Mail Seattle to San Francisco Projected

Seattle.—Air mail service between Seattle and San Francisco within a comparatively short time was forecast by Colonel Henderson, Second Assistant Postmaster-General, who arrived with a party of Postoffice Department officials on a national tour of inspection. "The Seattle to San Francisco service depends on two things," said Colonel Henderson. "We must first secure favorable action on a bill now before Congress giving us the right to have mail carried by private contract, and we must demonstrate the practicability of flying at night. I believe both these contingencies will be in our favor."

Wants Air Station on Barren Island

Barren Island has been suggested as a site for the naval air station now at Rockaway Point by Judge Alfred J. Talley, of General Sessions, in a letter to Admiral Moffet, chief of the Bureau of Aeronautics. Judge Talley is executor of the estate of Andrew White, which with New York City owns practically the whole island.

The letter is in reply to a statement made by Admiral Glennon to the effect that the removal of the air station from Rockaway Point would place the city at the mercy of foreign

invaders in case of war, and that there was no other point available for an air station. In his letter to Admiral Moffet Judge Talley said:

"May I not suggest that the dangers and difficulties occasioned by the action of the City of New York in relation to the air station at Rockaway Point can be avoided by establishing the station on Barren Island, which immediately adjoins Rockaway Point. Practically the entire island is owned by one private party and the city, and the unoccupied buildings could readily be made suitable to Navy uses."

In a letter to Admiral Glennon Judge Talley said:

"The plants formerly operating on Barren Island have been practically discontinued. The island is now connected via the Flatbush Avenue extension with the mainland, and the buildings now there could readily be converted to Navy uses."

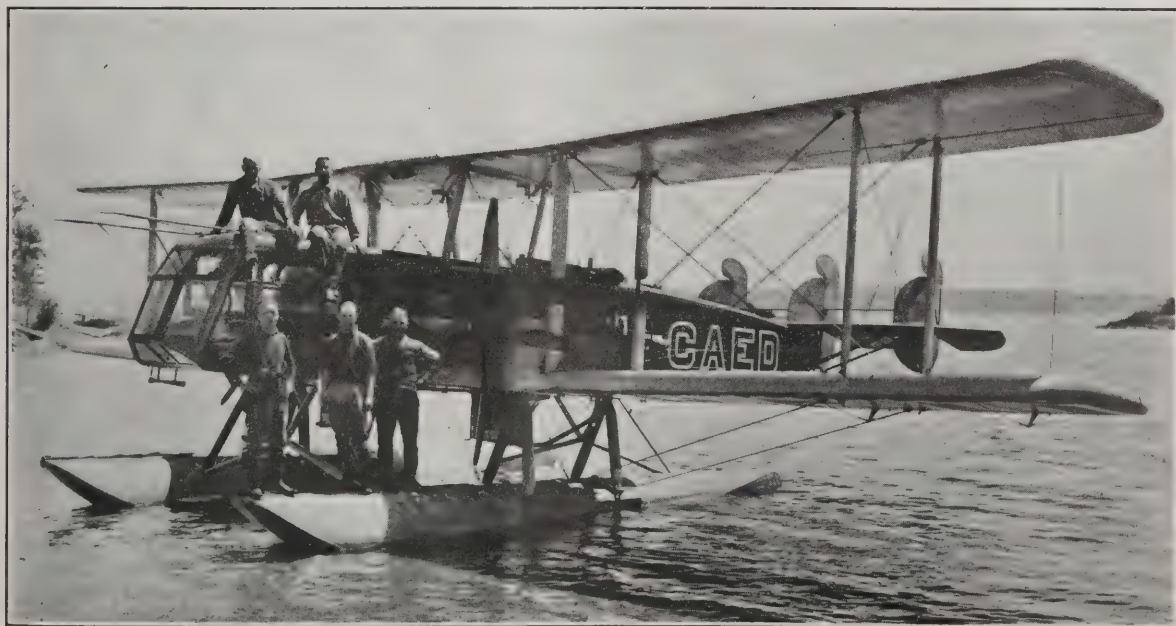
Barren Island was formerly used as a garbage disposal and dead animal rendering plant, but this use of the island ceased several years ago. The island is more than a mile long and half a mile wide. It is separated from Rockaway Point by Rockaway Inlet. Judge Talley also thinks that the island is so sheltered that aircraft could land and take off in the same waters they now use. He thinks that it has all the advantages of Rockaway Point and none of the disadvantages.

Aeroplane to Locate Alaska's Lost Lakes

Locating and photographing undiscovered lakes in the national forests of Alaska are the latest uses to which the aeroplane has been put, says the Forest Service, United States Department of Agriculture.

It has long been known that there are many lakes on the headlands and islands traversed by the inside passage between Seattle and Skagway that do not appear on any map. During the New York-Nome flight made by Army aviators, lakes were frequently sighted which could not be found on the latest and most authentic maps of the territory. Tales of unknown water bodies are constantly being brought in by trappers and prospectors. Less than a year ago a lake $4\frac{1}{2}$ miles long and $\frac{1}{2}$ mile wide was discovered at the head of Short Bay. This lake has over 1,000 acres of surface area and is less than $1\frac{1}{4}$ miles from tidewater, yet because of the surrounding country's rough topography has remained unknown and unnamed.

Recognizing that many other of these "lost lakes" may be sources of valuable water power, the Forest Service has laid plans to map this no-man's land of the north by means of aerial photographs. A few days' flight, it is said, will be sufficient to



The F.P.2 seaplane, built by the Dayton-Wright Company, especially for photographic work, mosaic and oblique, now being used by Walter E. Lees to make a mosaic of a thousand square miles of timber land for the Spanish River Pulp Co. of Canada. In the group are Walter E. Lees, pilot; Milton S. Beal, and J. R. Doty, camera men; Arthur Hayden and William Whitman, mechanics

cover the area with a degree of accuracy that would require many years and great expense to accomplish by ordinary methods.

The work, which has been approved by the Federal Power Commission, will be done by seaplane, flying from Ketchikan as a base.

The American Entries in the French Gliding Contests

The first successful gliding tests to be held in the United States since the Wright Brothers' experiments, which ended in 1903 with the world-famous initial flight of a motor-driven aeroplane, were announced today by the Aeronautical Chamber of Commerce of America.

The experiments were made on June 12th, at Ipswich, Mass., by three students of aeronautics at the Massachusetts Institute of Technology, Cambridge, Mass., who sail Saturday on the French liner *La Savoie*, to participate in the First International Gliding Contests, to be held August 6th to 22nd, at Clermont-Ferrand, France.

The participants on behalf of the Aeronautical Engineering Society of the Massachusetts Institute of Technology, are: Edmund T. Allen, age 26, of Chicago; Harry C. Karcher, age 20, of Mansfield, O., and Otto C. Koppen, age 22, of Mamaroneck, N. Y. Mr. Allen, who was formerly a test pilot for the Army Air Service at McCook Field, Dayton, O., is the pilot. The chief designing work, with the assistance of the Aeronautical Society, was done by Mr. Koppen. Mr. Karcher had charge of the practical construction of the glider.

The entrance of the United States into the international competition in France marks a new phase in the development of American aeronautics, according to officials of the Aeronautical Chamber of Commerce. Germany, deprived of the privilege of orthodox engineering, after the Armistice, turned to motorless aeroplanes, and at a competition last Fall, distances as great as 15 miles were traversed by gliders. France was quick to arrange for a general contest and experimentation has been going on ever since in most of the large nations of the world. There probably will be three score entrants in the French affair.

Messrs. Allen, Karcher and Koppen constructed a glider at the M. I. T. laboratories and on June 12th, Mr. Allen took it to a 50-foot elevation at Ipswich, Mass. He rose in a fifteen-mile head wind. Altogether five successful flights were made. The velocity of the wind was such that the machine hovered practically

the entire time. It reached a maximum elevation of twenty feet and advanced a maximum distance, in one flight, of 200 feet.

As a result of these trials, the young men, with the assistance of other aeronautical students at Cambridge, redesigned the glider into what they believe is the most efficient type yet produced anywhere in the world. The frail little aircraft, now stowed away aboard ship, has a span of 24 feet, a chord (or width of wing) of 4 feet 9 inches and measures 16 feet overall. It is of spruce and fabric construction and weighs but eighty pounds. The most successful of the famous German gliders weighs 149 pounds. Yet the Cambridge craft has a factor of safety of four. It is asserted by the builders that the craft has greater ease of control than the ordinary type of plane, having ailerons, rudder and flaps, the full length of the monoplane wing.

"The American aircraft industry will watch the results of the French competition with keen interest. The attention of the world is divided between the helicopter (machine capable of vertical flight) and the glider, or motorless aeroplane. Both have much to contribute, but the glider appeals probably more to sportsmanship. A great deal should be learned aerodynamically from motorless flight."

Notice to Aviators

At High Hill Beach, New York via Belmore, L. I., near U. S. Coast Guard Station No. 87, there is a large wooden platform painted green, with large white numbers 87 on the upper side. It is surrounded with green grass approximately two and a half to two feet in length, forming an apparently level surface of about one-half mile wide and two miles long. From the air this would appear to be an ideal landing field, especially as there is an indication that the numbers 87, but in reality it is exceedingly marshy and swampy ground, and should an aviator attempt to alight thereon there would undoubtedly follow some damage to the aircraft.

Correction

In our issue of August we stated that the flying field at Kansas City consisted of 53 acres, whereas as a matter of fact the field contains 153 acres, a portion of which has been leased to the Government. The contract for the erection of Government equipment has been let and the work should be completed sometime in October.

Aerial Mail Night Flying

Experiments have been made by the Post Office Department for a time immemorial for the improvement of the mail service to the citizens of the United States, but never before has the Department been pushed to experiment above the clouds. It is all due to the fact that the Post Office Department is considering establishing night flying.

Flying by night means much more than flying by day. It means lighted fields. Also it means constant communication between the planes in flight and the stations. At Bolling Field, Washington, D. C., a mail plane has been fitted with both receiving and sending radio telephone apparatus for communication tests. During flights over the capital city above the clouds conversation has been maintained successfully with the radio telephone station in the Post Office Department building.

Just as ships on the ocean, without radio lose themselves if the sun and the stars are obscured, the ships of the air lose themselves. At night air mail planes without radio equipment would be very apt to lose their way, run out of gasoline and finally crash to the ground. The Post Office Department wants to establish good air mail service, but it insists that that service must be safe.

With radio telephone equipment, ships could be given their position in ten minutes or less, it is estimated by officials of the Air Mail Service. The operation would be something like this: An air mail plane flying at night would call for its position. Radio operators in the stations from which the plane departed and to which it was going, by means of rotating finder would determine the exact direction the message came from. One station would then report the angle to the other station. This operator would draw a triangle on a map from the information received. The plane, of course, would be at the apex of the triangle. The flyer informed of his position, could quickly make his way back to the route.

Radio will also be used to report ground conditions at the stations to planes in flight. If a heavy fog settles over San Francisco the flyer with mail will be warned to land some place else. The passenger and mail planes between England and France are equipped with radio sets for such emergencies.

Further experiments which will now be conducted by the Air Mail Service, look toward simplifying the radio equipment in order to reduce the weight. The air mail plane detailed at Bolling Field now carries

radio equipment which totals about 100 pounds. It is believed this can be reduced at least one-half.

The mail plane reels in its experimental antennae like a fisherman reels in a trolling line. The antennae consists of a 300-foot copper wire which sails out behind the plane when in use, weighted by a little lead fish. Electric current to operate the radio telephone is manufactured by a generator run by a fan which spins at high speed as the plane rushes through the air. The radio receivers are enclosed in rubber cups to permit the pilot to hear the radio conversation above the roar of the motor.

Seaplane Mail Service

Sea plane mail service at New Orleans will be established soon, according to an announcement given out by the Post Office Department, in line with the policy to speed up mails at the chief American ports. The plane will catch outgoing steamers with the mail and bring in mail from the steamers half a day ahead of time. Announcement is also made of the placing of sea posts on five Oriental

steamers of the Shipping Board using the port of Seattle. Mail sorters on these steamships will sort the mail even down to carriers' routes for Seattle. At Victoria a sea plane will take the mail to the city 84 miles away and delivery will be made before the boat docks. At New York a special mail boat has been in service for some time taking off mail as the steamers arrive at Quarantine. A sea plane has been in service at Seattle for the period of a year and the results have been satisfactory. It was found, however, that to obtain the best service it was necessary to have mail clerks on the steamships.

A Plane Which Cannot Spin

Is the Petrel, which is now under test at McCook Field by the Engineering Section of the Air Service, so balanced and designed that a tailspin is impossible? This question has come up during the tests, in view of the fact that no pilot has been able to make the plane spin.

This question has probably to do with the center of pressure travel on the Gottinenn 387 wing.

The plane has been flown by Captain McCready, by Captain Mosely, by Art Smith, by Meister and by Pat Moriarty, for the Army, and by Mr. George B. Post for Huff, Laland & Co., its manufacturers. It has been looped and rolled. It has been flown in mimic combat by Pat Moriarty against the Vought, and has been placed in nearly every conceivable position. But no one has been able to make the plane spin.

All of the pilots who have flown it have reported enthusiastically concerning its maneuverability and ease of control over a speed range of nearly sixty miles. It is quite sensitive to all controls, and very easily and quickly turned. But, evidently, the plane will not spin.

When placed in positions where it should stall, with the controls so placed as to drop the plane "into it," the Petrel seems to fall off its lower wing in a side slip, from which it will emerge in a dive if let alone. Further information on this feature of the plane will be very interesting, in view of the efforts which have been made to design a plane which cannot fall in a tailspin.



Aeroplane view of Utah Copper Co. mine at Bingham, Utah, showing system of surface mining by steam shovel on terraces. Forty thousand tons of ore per day are removed when this mine is working full capacity. Photo by Capt. Le Mar Nelson, U. S. Air Service, Salt Lake City

THE AIRCRAFT TRADE REVIEW

Goodrich Re-enters Aeronautical Field

The B. F. Goodrich Rubber Company has announced its intention to resume the development and sale of aeronautical rubber products. The company's activities in this direction will embrace every field of aeronautics, including supplies for both lighter-than-air and heavier-than-air craft.

It will be remembered that during the war Goodrich was very active in this field, producing various types of balloons and large quantities of tires and supplies for the government.

The present decision to resume aerial operations has resulted in the addition to the company's personnel of Mr. Henry Wacker. Mr. Wacker, an experienced and practical aeronautical man, was formerly connected with the Curtiss Aeroplane & Motor Corporation and more recently with the Aerial Mail Division of the Government Service.

The Goodrich Company's resumption of activities in this field is significant of its belief in the future of the aircraft industry. With the experience gained during the war period, the company is well fitted to continue the development of this line of industrial merchandise.

To Use Duralumin in Goodyear Ship

AKRON.—Duralumin will be used in the construction of the new

government semi-rigid dirigible, by the Goodyear Tire & Rubber Co. of Akron, aeronautical engineers of the company announce.

The ship will be the largest semi-rigid dirigible ever designed and constructed in the United States and will be 290 feet long, with a capacity of 700,000 cubic feet of gas. It will be designed and built to carry helium gas in place of hydrogen gas. The bag will be 71 feet in maximum diameter. The ship will be equipped with four Liberty motors and two propellers in conjunction with two reduction gears for the purpose of getting higher propeller thrust efficiency.

The keel of the ship will be entirely of duralumin. The keel will be of triangular cross-section running from nose to tail, with a large structural nose cone and fixed tail surfaces all built into the keel, the idea being that considerable support will be gained from this structural backbone of the ship, thereby reducing car flying pressures.

The ship will have two gas compartments and two air compartments. It will have a speed of 70 miles an hour and will carry 15,000 pounds of gasoline.

The ship will have a crew of 12, with complete facilities for carrying 20, including six sleeping bunks, electrical cooking facilities and many of the conveniences common to modern ocean-going vessels. It will carry

three cars—the forward one being 5 feet long and 8 feet wide. The two power cars, each equipped with two Liberty motors of 400 horsepower each will be 20 feet long and 6 feet wide. All cars will be constructed entirely of duralumin members covered with duralumin sheeting. The total horsepower will be 1600. The motors, however will be throttled to reduce this to about 1200 horsepower for the purpose of increasing the durability of the engines. Facilities will be provided for free communication between the three cars through a passageway through the keel of the ship.

Means of getting on top of the huge gas bag will be provided through a vertical shaft 70 feet long, and a machine gun will be mounted on the top of the envelop to assist in protecting the ship during flight. Three other machine gun nests will be located in the lower part of the ship.

Grover C. Loening's Message to Aeronautic Executives

At the luncheon of the Aeronautical executives held at the Automobile Club of America, on July 12th there were present a great many of those who form the nucleus of the largest aircraft companies in the vicinity of New York.

In the spacious, airy banquet hall adjoining the library was set the luncheon table. Just behind the speaker's chair, raised on a small plat-



The Elias EM1 Expeditionary interchangeable land and water biplane

form stood the radio receiving set. Sharp at one o'clock by Washington came via the radio the luncheon began. During the course of the first half-hour thereafter, the weather reports came in, followed by wireless music.

It was sincerely regretted by those present that Colonel Henderson was unable to attend; but according to the telegram read by the chairman, R. R. Blythe, he was unexpectedly called to the Pacific coast owing to the crisis of the railroad strike. R. R. Blythe stated that the succeeding luncheon could be held when Colonel Henderson was available to speak.

Grover C. Loening, president of the opening Aeronautical Engineering Corporation, president of the Aeronautical Chamber of Commerce and well-known authority in aviation was introduced by the chairman as the speaker.

"Gentlemen, there is one vital message which must be conveyed to everyone in aviation and to all others who are interested in aviation and to the public in general; and that is, that America leads the world in aviation. "This is not a statement brought about by heated argument but one that is conveyed by cool judgment. We are here in the United States every world air record except the one-half kilometre speed record! This in itself is proof enough that our planes are the leaders of all other countries. "The general opinion of everyone is that America lags in aviation. We must combat this viewpoint with the conclusive facts that we lead the world. We have no Government subsidies to pay half our passengers' fares, we are breaking in from the solid rock foundation and yet with what we have done there are many who say that we are behind Europe.

"Compare the number of passengers carried, compare the miles flown. The United States so far has equaled or exceeded Europe in both the number of passengers carried and the miles flown.

"It means bank credits, and public confidence when we ourselves know and can feel the security that we do hold in aviation. It is one of the most vital things that we have to overcome today," said Mr. Loening. "We must have the self-assurance that we are on the winning side and going ahead. First convince yourselves and then in the expression of play—'You tell the world.'"

Plans to Center Aircraft Industry in Illinois

Seventy-two leading business men, including manufacturers, bankers

and merchants, held a meeting in the office of Mayor Thompson of Chicago, July 29, to make plans for landing the aircraft industry for Chicago.

Illinois lost the automobile industry because the people were not so active as the enterprising citizens of Detroit. If they can secure the aircraft industry—make Chicago the center of the aeronautical business of this country—they feel they will wipe out the motor car deficit.

"Chicago lost the automobile industry to Detroit," said the mayor. "As a result, Detroit has grown from a sleepy old town of a quarter of a million people to a population of approximately one million, gaining enormous wealth. Detroit today is bragging that she is going to overtake Chicago in population. The aircraft industry has arrived at a point where it is about to experience great expansion and prosperity."

Charles S. Rieman, president of the Chicago Aeronautical Bureau, which is conducting the active campaign to make Chicago the center of the aircraft universe, said:

"The country's leading transportation authorities—heads of big railroads and steamship lines—predict that the next few years will witness such an increase in air transportation that it will become one of the principal forms of industrial activity.

"Chicago now has no facilities for the manufacture and operation of aircraft, but by promptly supplying suitable landing fields and manufacturing sites, many young companies can be induced to move their factories to Chicago. If we wait until they have grown and established themselves elsewhere, we will lose them. Now is the time for Chicago to take advantage of her opportunity."

Ralph C. Diggins told how the company of which he is the head had made more than 15,000 flights in Chicago during the last year without a single serious accident. William P. MacCraken, Jr., chairman of the Committee on Aeronautical Law of the American Bar Association, urged adequate landing fields.

J. F. Cornelius, vice-president of H. O. Stone & Company, said that Chicago had been designated as the headquarters for the transcontinental air mail service as one result of the activities of the Chicago Aeronautical Bureau. A large sum of money was being expended to make the Chicago Air Mail landing field one of the finest in the country.

Mr. Cornelius then outlined the plan of the Chicago Aeronautical Bureau for making Chicago the center of the aircraft industry, as follows:

First: To bring to Chicago practically all of the people engaged in aeronautical activity in this country, in order that we may convince them in a wholesale way that Chicago is the best place in America in which to manufacture aircraft and from which to operate the air transportation lines.

At the conclusion of Mr. Cornelius' remarks, John M. Glenn, Secretary of the Illinois Manufacturers' Association, and George B. Foster of the Commonwealth Edison Company both expressed hearty approval of the purpose and plans of the Chicago Aeronautical Bureau, and upon motion of Mr. Glenn, seconded jointly by James S. Agar, president of the Agar Packing and Provision Company, and Robert M. Birck, president of the Cleaners' and Dyers' Association, the following resolution was unanimously adopted:

That it is the sense of this meeting that we approve the plans of the Chicago Aeronautical Bureau to make Chicago the center of the aircraft industry, and that immediate action be taken to provide the necessary funds.

The Chicago Boosters' Club headed the list with a subscription of \$5,000.

Florida Aviators to Make Cross-Country Flight

Mr. H. E. Cornell, vice-president of Glen Saint Mary Nurseries of Winter Haven, Fla., very well known all over Florida for his interest in the development of the citrus industry; Mr. George W. Haldeman, ex-Army officer, member of Aero Club of America and Aerial League of America, president of the Inter-City Airline Corp. of Lakeland, Fla., well known in exhibition work over the Southern States for the past three years, having filed exhibition contracts at most of the largest fairs in the South.

Cornell and Haldeman left Lakeland, August 7th, at noon, by train arriving in Dayton, Ohio, August 8th, where they have purchased a new high-powered commercial aeroplane of the Johnson Aeroplane & Supply Company of Dayton. The machine is powered by a 225-h.p. Benz motor and carries a gas supply of ninety gallons, capable of about six hours' flying. Her average speed is approximately 120 miles per hour.

Messrs. Cornell and Haldeman declare that they are not intending to break any cross-country flying record but are merely taking a 7,000-mile pleasure trip by air. Their new plane has been christened the "Skylark."

The start in their plane will be made at Dayton, Ohio, their course taking them through St. Louis, Kansas City, Denver, Salt Lake City,

Boise, Idaho, and Walla Walla, Wash., which is their destination going out, Mr. Cornell expecting to visit for some time there with his brother, W. B. Cornell.

En route to Walla Walla the aviators expect to stop at McPherson, Kan., Mr. Haldeman's old home, where they will visit for a few days. They expect to make several side trips from Walla Walla, one of which will take them to Seattle, Wash., on the coast, from where they will start their return trip. The return will be made

over a northern course, through Montana, North Dakota, Minnesota, Wisconsin, Chicago, Ohio and Pennsylvania to New York City. Here the aviators expect to spend about a week.

From New York they will return to Florida via Washington, D. C.; Newport News, Va.; Wilmington, N. C.; Savannah, Ga., and Jacksonville, Fla., bringing their trip to a close at Winter Haven, Fla., Mr. Cornell's home.

Mr. Cornell has for the past year been flying with Mr. Haldeman on

business trips around Florida and during the past sixty days has completed a course of instruction of over a hundred hours in the air, having his instructor Mr. Haldeman, who has approximately two thousand flying hours to his credit.

After learning to fly Mr. Cornell was so impressed with the safety and practicability of the aeroplane that he decided to purchase a higher power machine, and, together with Mr. Haldeman, tour the United States.

Plans of the International Manufacturing Co. of Los Angeles

The development of Airway Load Carriers by the International Transportation & Manufacturing Company of Los Angeles, is a new step in the effort to provide commercially efficient aero transportation. The Airway Load Carrier is designed, in a sense, as a combination of heavier-than-air and lighter-than-air principles, but its originators assert that it is distinctly a third type of aircraft.

The development was reached through several years of preliminary work and testing by the Hall Aeroplane Company, a California corporation, capitalized at \$500,000. Most of this work was done at Los Angeles and Berkeley, California. The prime mover in this development is Charles S. Hall of Los Angeles, formerly an automotive engineer, and associated with him are G. B. Hannaman of Auburn, California, and D. Nelson Clark, of Long Beach, California, and a number of other Western men who are interested in aeronautics. Mr. Hall began the development of propellers after some years of study of propeller efficiency and has obtained patents on an entirely new type known as the "Hall helicoidal propellers," in which efficiency begins at the hub through special arrangement of a helicoidal projection. Tests of this propeller have demonstrated unusual efficiency and very quick "bite" of the air when the propeller is started. This feature was sought by Mr. Hall to bring about an efficiency desired in the handling of large aircraft, especially in taking off and alighting. It is also utilized to give an increased lift by using Hall propellers on a newly developed application to heavier-than-air craft.

The development of plans for the production of Airway Load Carriers

has been very thorough and has taken four years of constant experimenting and research. This has been carried on alike from the engineering and commercial viewpoints, so that a system of tariffs and special marketing has been developed along with the plans for construction. As a result, the company begins its active work with an established method for determining the costs of operation and for practically laying out schedules and placing terminals and stations along with a system of calculating and undertaking the engineering features of construction.

Surveys which have taken a number of years have been made for routes and the establishment of landing locks and stations and radio compass stations across the country and into Mexico. The system of computing tariffs has received the assistance of traffic men and has also had the supervision of experts in other lines who have made sure that nothing was neglected in the plans. This has been followed by rigid cost analyses in which every charge—capital outlay, gross operating, etc.—has been taken into account and for which standards have been established for salaries, wages, depreciation, liabilities, damages, legal burdens, terminals and stations, subsidiary trucking companies, etc.

A method of mechanically handling the alighting of these craft and of locking them in loading stations and a very ingenious and rapid means of handling freight to give greater safety and expedition have been developed. The Company has acquired many basic patents and has others in the course of issuance on special features relating to the Airway Load Carriers and other aircraft accessor-

ies, and expects to have more than one hundred patents before completing protection on the essentials and accessories already developed. D. Nelson Clark, counsel for the Company has been spending the summer in Washington and New York, looking after patents and other developments.

Curranium gas is not owned by the International Transportation & Manufacturing Company, as has been stated, but is privately owned by individuals, and no stock relation to its production is on the market. The owners of Curranium and D. Curran are interested, however, in the International Transportation & Manufacturing Company, and the concern holds an option on the use of the gas in aircraft work following its production.

The International Transportation & Manufacturing Company will construct Airway Load Carriers of moderate capacity at the outset and put them in a combined freight and passenger business. The first fleet will probably have no carrier of more than eighteen tons pay-load capacity. The cost analysis of operation of these craft are, at present, based upon the use of Liberty engines, although Mr. Hall and his associates believe that the larger load carrying aircraft must sooner or later come to a more efficient means of power than the internal combustion engine.

The International Transportation & Manufacturing Company is capitalized for \$2,500,000. It maintains general offices at Suite 824-827 Santa Fernando Building, Los Angeles, but expects to establish its initial factory at San Diego, where land has been acquired for that purpose.

ARMY *and* NAVY AERONAUTICS

Air Service R. O. T. C. Summer Camp Opens at Kelly Field

The Air Service R.O.T.C. Summer Camp, under the command of Major C. W. Russel, A. S., (D.O.L.), opened at Kelly Field on June 15th with sixteen Texas A. & M. College students in attendance. It was originally planned to have about thirty students at the camp this summer but, due to the rigors of the 609 (physical) examinations for pilots, the remainder were disqualified.

The course of instruction is very practical, and is being made as comprehensive as possible for the six weeks' duration of the Camp. Theoretical instruction is being reduced to a minimum, due to the fact that this has been largely covered during the students' course at College. The mornings are devoted solely to flying, while the afternoons are given over to necessary lectures and conferences on the next day's missions. Instruction and practice is being given in every phase of back seat work.

The students are all very enthusi-

astic about the flying game, and will undoubtedly prove consistent boosters for the Air Service.

Engineering Men Visit Chanute Field

The Society for the Promotion of Engineering Education, consisting of professors and instructors in Engineering and Mechanical Work from the various technical schools and universities in the United States, were guests at Chanute Field, Rantoul, Ill., recently. A special car brought the visitors to the field, where they were conducted in small parties through the Air Service Mechanics School by the officers, noncommissioned officers and civilian instructors. Each party visited each course of instruction in operation, which was explained very carefully by the guide.

At the completion of their tour of the departments and hangars a flying exhibition was given to afford the visitors an opportunity to study the various types of aeroplanes in use.

The aeroplanes were DH4B's Fokker, SE5's, and the T.M. Scout. The visitors expressed themselves as greatly pleased with the afternoon spent at the field and at the manner in which the training of mechanics is being conducted at this school.

Bombing Maneuvers at Galveston, Texas

A crowd, variously estimated between 25,000 and 50,000 people, witnessed the bombing of the schooner *Navided* off Fort Crockett, Galveston, Texas. The seawall was black with spectators and cars were parked wherever room was obtainable. From a tactical standpoint, the exercises were a marked success. Those who knew what it was all about had ample demonstration of what the Air Service, properly equipped, can do to ships at sea, and the pilots who took part are entitled to the satisfied smiles they are wearing. All of the bombing was done with dummies of tile, since the live bombs obtained could not be



Construction frames of the giant dirigible ZR1 at the Naval Aircraft Factory, Philadelphia



The U. S. S. Wright fleet tender for the Atlantic Fleet Air Squadrons

used in racks of the type with which the ships are equipped. Even so, the last attack left the *Navided* on fire in the hold, to burst into flames upon the withdrawal of the planes. The opening attack was made with two 5-ship formations of SPAD XIII's dropping four 25-pounders and getting a very creditable percentage of hits on deck, in spite of the fact that the minimum altitudes for live bombs were adhered to. The SPADS were followed by a formation of five DH4B's from Kelly Field dropping full loads of 25-pounders.

It was obvious to any observer that, if bombs of the types ordinarily used against craft of this type had been employed here, every seam in the hull would have been wide open to the sea after the DH's were half through. This attack was followed by two formations of SE5's dropping 4 bombs each, 3 of the planes remaining to attack with machine guns.

The First Pursuit Group expects to have more of this sort of thing at Selfridge Field, the unused shallow portions of Lake St. Clair offering a convenient location for either practice or demonstration.

Opening of R. O. T. C. Students' Camp at Mitchel Field

The R.O.T.C. Student's Camp for the 25 students of the Massachusetts Institute of Technology officially opened at Mitchel Field, L. I., New York, on Monday, June 19th. The students arrived June 15th, and were immediately quartered in barracks previously provided for them. The mess was opened and camp routine fully established in order that the schedule of instruction might start promptly at 8:00 a.m., Monday, June 19th. To date the schedule as previously submitted for this camp has been carried

out fully. There have been interruptions in the flying portion of the schedule due to inclement weather. This, however, has been made up in the afternoons and on Saturdays. The students are receiving on an average of one hour of flying per day. No pilot instruction is, of course, being given them, but they are being given flights in connection with the instruction in photography, aerial observation, map making, etc. The school is operating more smoothly and harmoniously than was anticipated. It would appear from reports that the students are enjoying the course and are finding it very instructive. In order to carry out the program, eight aeroplanes are being detailed daily to the duty of flying these students.

Eberts Field Reunion

There will be a reunion of the men who were at Eberts Field, Lonoke, Ark., during the war on September 21-23 inclusive. Headquarters have been established at the McAlpin Annex, formerly the Martinique, New York City, and complete information can be had there from Lt. J. E. Bullock. An excellent program is being arranged and it is hoped that every man who trained at Eberts Field will respond.

Army Flyers Make 122 Miles an Hour on Overland "Hop"

Washington.—Lieut. James H. Doolittle and Leland S. Andrews,

Army Air Service, flew from Kelly Field, San Antonio, Tex., to Bolling Field, Washington, a distance of 2,080 miles, in eighteen hours.

This announcement was made by the War Department. The fastest time made by Doolittle and Andrews was when they flew from San Antonio to Jacksonville, Fla., with short stops at Houston, Tex., and Pensacola, Fla., a distance of 1,220 miles, which was made in ten hours' flying time, an average speed of 122 miles per hour.

They flew from Jacksonville to Washington, a distance of 860 miles, with a short stop at Langley Field, Va., in eight hours.

Night Flying Tests

Further experiments in night flying by the Post Office air service will be started at the McCook Field, Dayton, Ohio, to supplement tests being made in radio communication at Bowling Field, Washington.

A mail aeroplane has been ordered transferred from the Chicago station to Dayton, where the experiments will be pushed ahead rapidly. Under the direction of army experts in night flying this plane will be provided with searchlights and other necessary equipment for flying in darkness, after which actual flights at night will be made.

At the present time there is only one other aeroplane in the United States equipped for night flying. It is at the McCook field, Dayton.

REVIEW of WORLD AERONAUTICS

New British Air Service

The British Air Ministry announces:—A scheme for the establishment of air services between Southampton and the French ports of Cherbourg and Le Havre has been approved by the Air Ministry. The services will be operated under the general terms of the subsidy scheme made public in June of last year.

A new company, probably with the title of the British Marine Air Navigation Company, Limited, is being formed to operate these new services, and in addition to the promoting company certain shipping companies will be financially interested in the scheme.

These services mark an important stage in the development of commercial aviation as the company will use, for the first time, marine aircraft designed and built by the Supermarine Aviation Works, Limited. The existing British services use land types of aircraft only. The need for establishing services using this type of aircraft was emphasized in 1919 in the Report of the Advisory Committee on Civil Aviation.

The main object of the scheme is to shorten the Cross-Atlantic journey by

picking up passengers from Cherbourg, conveying them rapidly by air to Southampton, and thence onwards to London by train. In addition, the company intend to operate a Southampton-Le Havre service in order to speed up travel on the Cross-Channel section between London and Paris for passengers proceeding by this route.

In both these schemes the company has the active cooperation of the London and South Western Railway Company in connection with through bookings between the terminal points on each route.

Subsequently it is proposed to operate a service between England and the Channel Islands for passengers, produce, newspapers and mails. This air service will also reduce very greatly the time taken between the Islands and the mainland.

The company will receive a subsidy of 25 per cent on the gross earnings from the carriage of passengers, goods and mails, and also a payment of £1 10s. per passenger carried and 1½d. per lb. of goods carried. The latter payments are half the sums paid to approved companies operating the London-Paris air services.

The French authorities have been approached for the provision of the necessary customs facilities at their ports, and the French railway companies concerned are also assisting by providing suitable train connections on their part of the through route to Paris.

Saying It with Flowers by Air

Information that Dutch florists have adopted the expedient of sending their flowers daily to the London market by aeroplane has been received by the Department of Commerce from Trade Commissioner Howard W. Adams, The Hague. The flowers are cut at night, packed early the next morning, and sent by motor-car from the Boskoop flower growing district to the Waalhaven aerodrome near Rotterdam. They arrive at Croydon, England, at 1:30 P. M., and from there are despatched by motor-car to the London florists. Boskoop flowers are thus put on sale simultaneously in the London and Dutch shops. About 100 kilograms of flowers per day are to be transported in this way.



Navy VE7 seaplane leaving turntable catapult on the U. S. S. Maryland

Spain-Argentina Line

Washington.—A despatch received from Ambassador Cyrus Woods announces that an airship service across the Atlantic Ocean from Seville, Spain, to Buenos Ayres, Argentina, will be established.

The enterprise, Ambassador Woods states, is being financed partly by British capital. It is hoped to inaugurate a regular airship service within the next two years. Sites for aerodromes have been obtained in both cities and building operations are to start soon.

The airships to be used in the transatlantic service will be somewhat larger than the ill-fated R-38. They will be driven by nine Maybach engines, each of 400 horsepower. Four engines will be placed on either side of the ship, with one in the stern.

The plans call for cabin accommodations for forty passengers. Space for passengers is to be limited so that the major part of the carrying capacity can be utilized for the transportation of mails. It is proposed to establish a postage rate of 75 cents per letter, while \$1,000 will be charged per passenger.

The cabin will be situated in the forward part of the hold and includes quarters for the ship's officers, a saloon, a kitchen and a smoking room. Space for baggage will be provided along the keel.

Traffic on Cross Channel Routes

The British Air Ministry announces:

The returns of air traffic on the Cross-Channel routes to Paris, Brussels and Amsterdam during the three months, April-June, are now available.

During this quarter 764 machines departed from the London Terminal Aerodrome, Croydon, and 768 machines arrived, the total number using the aerodrome on Continental services being 1,532. This is a considerable increase on the figures for the same period last year, when 506 machines departed and 495 arrived.

The majority of machines were of British nationality, belonging to the Handley Page Transport, Limited, the Instone Air Line and Daimler Hire, Ltd. The figures by nationality are: British, 915; French, 228, and Dutch, 189. Last year British machines numbered only 246 out of a total of 1,001 machines using the aerodrome.

The total number of passengers carried during the period was 3,128, and is a slight decline on the total of 3,565 carried a year ago. The proportion carried by British companies has, however, greatly increased, 2,402 traveling in British machines against 1,653 in the same period last year. British traffic, therefore, amounted to 76.8 per cent of the total, whereas last year it was only 46.4 per cent.

The total weight of goods carried by aircraft to and from Croydon was 144 tons, which is a large increase on last year, when the figure was 56.9 tons. Half of this total was carried by French machines, but the

British share of the traffic shows the largest proportionate increase, 53.6 tons having been transported by British machines against 4.9 tons a year ago.

The efficiency of British air services continues to be of a high standard. In April the efficiency of flights made and completed within four hours by British machines on the London-Paris route was 92.3 per cent. For May the figure was the same, and for June it rose to 95.2 per cent. The figures for French machines during the same period on the same basis were: April, 71.3 per cent; May, 85.0 per cent, and June, 79.1 per cent.

Notwithstanding these figures it has to be noted, however, as stated in the last half-yearly report on Civil Aviation, that a considerable increase in traffic is essential if air transport firms are to obtain a commercial basis of operation, the passenger accommodation occupied on British machines being only 37 per cent in April, 30 per cent in May, and 31 per cent in June, and the useful cargo capacity used only 44 per cent in April, 44 per cent in May and 40 per cent in June.

British Air Council

An Order in Council to be published shortly by the British Air Ministry enacts that the Air Council shall consist of the following members:

One of His Majesty's principal Secretaries of State, who shall be president of the Air Council.

The Parliamentary Under Secretary of State for Air.

The Chief of the Air Staff.

Air Member for Personnel.

Air Member for Supply and Research.

The Secretary of the Air Ministry.

The main intention of the New Order in Council, which replaces that of October 13, 1920, is to redistribute the business of the Air Council and adapt the organization of the Air Ministry in such a way as to meet new requirements and increased responsibilities, and in particular to relieve the Chief of the Air Staff of some portions of the detailed administration of the Royal Air Force, which were previously under his direct control.

The main changes are as follows:

(1) The title of Air Member is given to each of the Members of Council serving in offices held by officers of the Royal Air Force, and the Chief of the Air Staff is described as the first and senior Air Member of Council and principal adviser to the Secretary of State in the direction of the Air Force.

(2) Subject to (1) above, the Air Member for Personnel will be responsible to the Secretary of State for the administration of business relating to the personnel discipline and organization of the Air Force, and the Air Member for Supply and Research (lately Director General of Supply and Research) will, in addition to the business already allocated to him under the

previous Order in Council, be responsible to the Secretary of State for the administration of business relating to the equipment of the Air Force.

The Order also provides, having regard to the recent termination of the post of Controller General of Civil Aviation and its replacement by a post of Director of Civil Aviation responsible to the Parliamentary Under Secretary of State, that the Under Secretary of State shall in turn be responsible to the Secretary of State for business relating to Civil Aviation.

The Air Council, as reconstituted, is composed as follows:

Secretary of State and President of the Air Council, Capt. the Rt. Hon. F. E. Guest, C.B.E., D.S.O., M.P.

Parliamentary Under Secretary of State and Vice-President of the Air Council, the Rt. Hon. Lord Gorell, C.B.E., M.C.

Chief of Air Staff and Senior Air Member of Council, Air Chief Marshal Sir H. M. Trenchard, Bart., K.C.B., D.S.O. A.D.C.

Air Member for Personnel, Air Vice-Marshal O. Swann, C.B., C.B.E.

Air Member for Supply and Research, Air Vice-Marshal Sir W. G. H. Salmon, K.C.M.G., C.B., D.S.O., p.s.c.

Secretary, Sir W. F. Nicholson, K.C.F.

Circuit of Great Britain

For the King's Cup, which has been presented by His Majesty the King for the circuit of Great Britain by aeroplane, a number of entries have already been promised, including the following:

The Duke of Sutherland (president of the Air League).

Lieut.-Col. Frank K. McClean (vice chairman of the Royal Aero Club).

Sir Samuel Instone (Instone Air Line).

Sir Henry White Smith (Bristol Aeroplane Co., Ltd.).

A. V. Roe (A. V. Roe & Co., Ltd.).

H. Scott-Paine (Supermarine Aviation Works).

A. S. Butler (de Havilland Aircraft Co.).

Brig.-Gen. J. G. Weir, C.M.G. (J. & G. Weir, Glasgow).

Col. M. O. Darby (Aircraft Disposal Co., Ltd.).

F. P. Raynham.

In addition to the above, Boulton & Paul Ltd., of Norwich; Armstrong-Siddeley Motors, Ltd., Coventry; Gloucestershire Aircraft Co., Cheltenham; Aircraft Disposal Co., Ltd., Croydon; Handley Page Transport Co., Croydon; Fairey Aviation Co., Hayes, and Short Bros., of Rochester, are preparing machines for the race.

The race will be a handicap under the Competition Rules of the Royal Aero Club and the King's Cup will be awarded to the entrant of the aeroplane which first completes the circuit of Great Britain of approximately 850 miles.

FOREIGN TECHNICAL DIGEST

The New B. M. W. Engines

The Bayerische Motor Works of Munich have just produced two new engines of the well-known B.M.W. type, best known by the 185-h.p. engine used in making a recent "American" world's record for duration, and so largely used in recent German aircraft.

The new engines both follow the general arrangement of this well-known B.M.W. IIa type.

The engine here illustrated is the smaller of the two. It is rated at 120 h.p.; develops 40 h.p. at 1,400 r.p.m., and has a very low fuel consumption for so small an engine. It is known as the B.M.W. II.

The second engine is rated at 240 h.p. and develops 260 h.p. at 1,400 r.p.m. Very great attention has been paid to the reduction of fuel consumption and it is said that it can run on 170 grammes (.375 lbs.) per h.p. hour. This figure sounds highly improbable—the guaranteed figure of 195 grammes (.43 lbs.) is sufficiently extraordinary. This engine—like the earlier 185 h.p. one—is of the super-compressed over-mentioned type and maintains its full normal output up to an altitude of about 10,000 ft. Owing to the restrictions on the construction of German aircraft and engines, this type may not be manufactured in Germany at present, but doubtless steps will be taken to construct these engines in some other country.

Specification of the New B.M.W. Engines TYPE B.M.W. II.

Normal power.....	120 h.p.
Full power (1,400 r.p.m.).....	140 h.p.
Number of cylinders.....	6
Bore.....	120 m/m.
Stroke.....	120 m/m.
Weight, dry.....	210 k.g.
Fuel consumption per h.p. per hour.....	230 g. (.51 lbs.)
Oil consumption per h.p. per hour.....	12 g. (.026 lbs.)

TYPE B.M.W. IV

Normal power.....	240 h.p.
Full power (1,400 r.p.m.).....	260 h.p.
Number of cylinders.....	6
Bore.....	160 m/m.
Stroke.....	190 m/m.
Fuel consumption per B.H.P. per hour.....	195 g. (.43 lbs.)

Petroleum as Power Fuel for Aeroplanes

On the 5th of July in Seeland, from the aerodrome of Lundteft, near Copenhagen, the first trip in the world took place with an aeroplane which used petroleum as power fuel, a proceeding which, apparently, signifies a landmark in the development of flight and automobile service. It deals

with a petroleum carburetor, an invention of the well-known Dane, Ellehammer. After tests having been made for some time past in the laboratory as well as with an automobile, the carburetor was placed in a Rumpler aeroplane with a 150-h.p. Benz engine. As power fuel ordinary petroleum was used, bought in a nearby shop at 25 cere per kg., while benzine costs 80 to 90 cere. After the petroleum had been poured into the tank, the Rumpler aeroplane went on its trip with flier Johansen for pilot, as well as a workmaster and a civilian flier as passengers. A number of experts were present at the test. It was evident that the engine ran satisfactorily in every respect. It flew just as well as with benzine; the vibration was less and not the least soot formed. There was consumed a smaller quantity of petroleum than of benzine. The carburetor used was only calculated for a 60-h.p. engine, whereas the engine in the aeroplane, as mentioned, was of 150 h.p. The only effect was that the engine had 100 revolutions less per minute; but, in spite of this, the aeroplane flew well. Formerly two ordinary benzine carburetors were used for the feeding of the six cylinders. On account of the result the Danish Air Navigation Company will operate their aero-

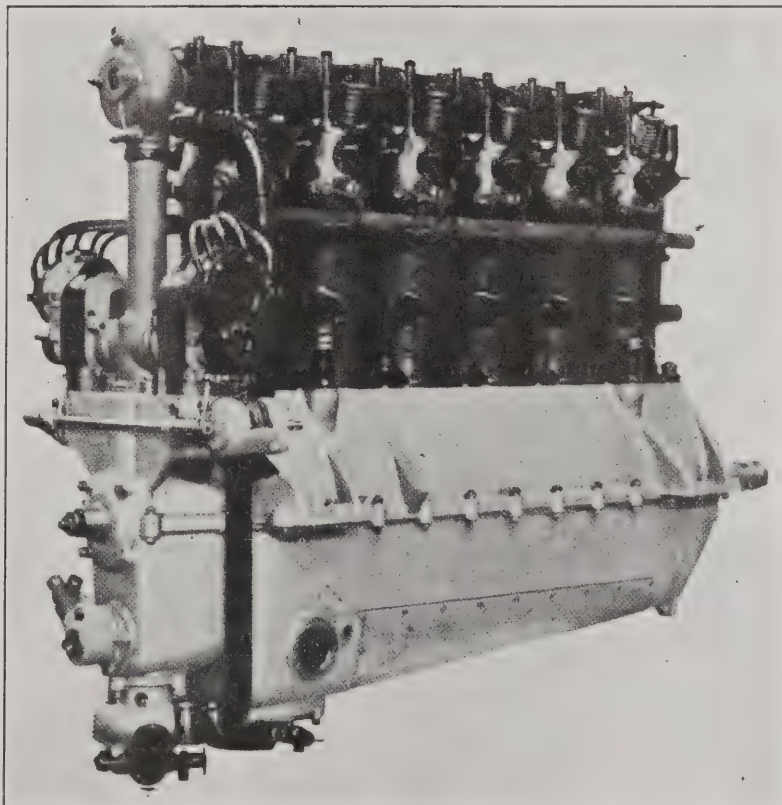
plane engines with petroleum. According to the statement of the experts, the fuel burns completely, the danger of self-ignition is entirely done away with, as the new carburetor is a so-called dry carburetor. Smell and soot are absent. One may, after this—on account of the more diminished danger of ignition of the petroleum as compared with benzine, benzol, spirit, etc.—expect a revolution in aeroplane and automobile operation. England alone uses yearly engine benzine at a cost of £30 mill. Petroleum costs only one-third.

Meteorological Advice for the Air Traffic

By A. Schmauss—Munich

THE necessity of meteorological advice to the commercial flier is universally acknowledged. Even in the war, where little heed was paid to human life and material, as compared to the conditions of peace time, a wide-spread weather service was organized for the safety of the air service. It has acquired particular importance with the introduction of air traffic.

There are two ways to reach this end: a centralized service of safety and "information sources" organized in sections. Germany possesses so far only the first-



The New B. M. W. Engine

named part of the organization, the so-called "high strata" information of the Prussian Aeronautical Observatory at Lindenberg. In the early morning a selected series of suitably distributed post or telegraph offices, making use of a code prepared by the Observatory, report on the weather conditions of their localities and the state of the ground, either directly to Lindenberg or via a collecting center. At Lindenberg the reports are examined, supplied and worked out to a "line forecast," thus enabling aeroplanes, starting immediately after the Lindenberg wireless message, to be well informed about the first part of their flight. This supposes, though, that at the time of start there exists a receiver for wireless and specialists are at hand, able quickly to decipher that part of the naturally lengthy Lindenberg message, which is of importance for the respective line.

Now, such a centralized system would suffice if the weather would not change or if the meteorologist on service at Lindenberg was capable of forming a prediction of the coming changes. But this is not the case. If there is no possibility of one general weather forecast, made at one center for the whole of Germany, this is still less feasible with a weather service for air traffic, since the phenomena, of greatest importance for flying, such as fog or thunderstorms, are by nature local ones, and therefore require also an intimate acquaintance with the local conditions. A line may be blocked, according to the 7 A. M. message, by fog, the cessation of which might hardly be timed in advance by the resident observer. If the weather condition is one of "thunder in the air," the control station can but give a warning of precaution, the influence of which on flying work will naturally diminish with growing distance from the service.

Thus we cannot do, in addition to the most serviceable centralized information service, without line assistance, which as yet is very backward in its organization. Let us take, as an example, the so-called "North-South Flight" Berlin—Leipzig—Furth—Munich—Augsburg. At 7 A. M. a number of post offices situated along this line report to Lindenberg (by indirect ways which may remain unmentioned), at 8.10 A. M. Lindenberg issued its statement for this line, together with the reports of the other parts of Germany. We assume that the flight control station at Furth and Leipzig furnish the pilots, starting at 10.15 A. M. for Leipzig and at 10.00 A. M. for Furth—both having to cross a bit of mountain country—with the deciphered data of the part of the wireless, concerning these intervals of the route. Will the pilot feel satisfied with these reports? No; they wish for fresher news and an expert's advice, if possible by word of mouth, particularly if atmospherical conditions of so quick variability are in question, as fog or tendency to thunder storms.

The central meteorological office of Bavaria has tried to fill up this gap by establishing a weather station on the Furth airdrome; but its future is not secured yet, from the financial standpoint, the air traffic companies refusing, to the general surprise, to contribute towards the expenses, though they have declared their readiness to cover the costs of the telegrams necessary for the centralized safety service. As it is customary that traffic lines have to bear all the expenses necessitated for their safety, the Air Companies held that the weather stations on airdromes should be supported by the State or the Community to which the airdrome belongs. We do not wish to discuss this controversy here and wish only to insist on the urgency of meteorological advice being supplied upon the airdromes. It will hardly enhance the feeling of safety on the part of the pilot if, instead of a line forecast issued hours ago at Lindenberg, he receives the advice of a meteorologist familiar with the details of the line, the latter one being able to inquire and receive, by means of the Lindenberg code, special information from particularly perilous portions of the line shortly before starting time—a detail of special importance if this starting time had to be suddenly changed. As the flight is performed by intervals, meteorological advice should also be given accordingly. Practicians may decide to which system they like to give preference; according to my war experience, to me the answer seems to be plain.

Naturally there is no need that such weather stations should do service exclusively for air traffic; if situated in university towns, they can well be annexed to the universities; thus enabling the latter to add to the lectures on meteorology, the practice necessary, and these weather stations might also, in the quality of local centres of forecast, furnish weather information and such like to the papers.

One more important question must be mentioned. How far should the pilot take the weather reports into consideration? First of all, it ought to be made a legal regulation that the pilot is obliged to personally read the weather reports at hand at every aviation field he touches. Practical America has understood it: the insurance companies there do not pay any premiums whenever an accident is to be attributed to the non-heeding of a weather report. To what extent the pilot will give heed to this report is, naturally, dependent on the degree of personal confidence he places in the meteorologist. I cannot approve of an air traffic company saying expressly in their report that on 10 days, for which the weather service had set the forecast "no flying weather," they have fully performed their regular flights. There ought to be a difference made between flying for the sake of sport and the working of a company to whom passengers confide themselves against a remuneration.

When selecting pilots, their meteorological fitness should be taken just as well into account as their technical ability. It should not be tolerated that a pilot should only be acquainted with his aeroplane; he ought also to be familiar with the peculiar properties of his fairway if the meteorological advice is supposed to be of real value.

A New French Flying Boat

On June 10th the first of the new three-engined flying boats intended for the service between Antibes and Ajaccio (Corsica) arrived at the air-port of Antibes. This machine, registered as "L.E.O.6," made the journey from Saint-Raphael about 25 miles, in 22 minutes, in spite of very unfavorable weather, the pilot being M. Martin.

The machine loaded weighs 8,800 lbs. The central motor is a Salmson 260 h. p. and the other two are Hispano-Suizas of 150 h. p. each, or a total horse-power of 560. The pilot is housed in a small separate compartment by himself with the necessary instruments and wireless outfit, and below him is a spacious cabin seating six passengers. At two-thirds of its full power the speed is said to be 90 m. p. h.

The flying boat, which has been built by Les Etablissements Lioré-Olivier for the Cie. Aéro-Navale, which has the concession for the service between Antibes-Ajaccio-Tunis, was designed largely by M. J. Barthe, a director of that line, and after thorough trials will commence its duties between the Riviera and Corsica, where the air traffic is already reaching considerable proportions.

New Fokker Plane Speedy

The Hague.—The Dutch aviator and inventor Fokker, who recently returned from his successful trip to the United States, has just completed two new commercial monoplanes for the Royal Dutch Aviation Company.

The trial flights proved that these monoplanes far surpassed the other Fokker models in efficiency and speed. They can carry a weight of 1,250 kilograms and can fly six hours without landing with six passengers and 200 kilograms of baggage, for which special space is allotted. They are fitted with a Rolls-Royce motor, making an average speed of 160 kilometers per hour.

One advantage of the model is that the whole nose, with the motor and screw, can be detached in a few minutes and replaced by another.

ELEMENTARY AERONAUTICS and MODEL NOTES

Model Aeroplane Club Activities in Chicago, Washington and New York

The National Scientific Society

THE attempt to form an alliance among the various model-aircraft clubs over the world for the purpose of compiling international standards so that competitions may be carried out on a recognized basis, appears to be heading towards success.

Besides having met with the hearty approval of many men prominent in American aircraft circles, the idea has been spoken of by organizations and individuals as one which bids air to promote a growth of enthusiasm both among those interested in aeronautics and by the general public.

Having taken the initiative in working towards that goal, the Norsk Aeromodels Klub of Kristiana, Norway, and the Aeronautical Engineering Department of the National Scientific Society (of New York City), have already commenced to formulate laws which, upon completion, will be presented for the approval of those interested in international competitions.

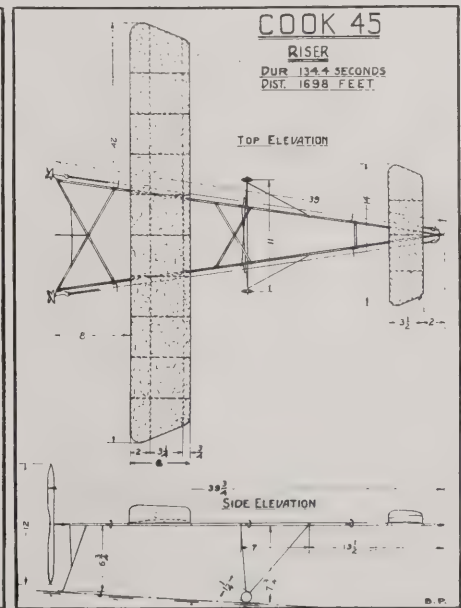
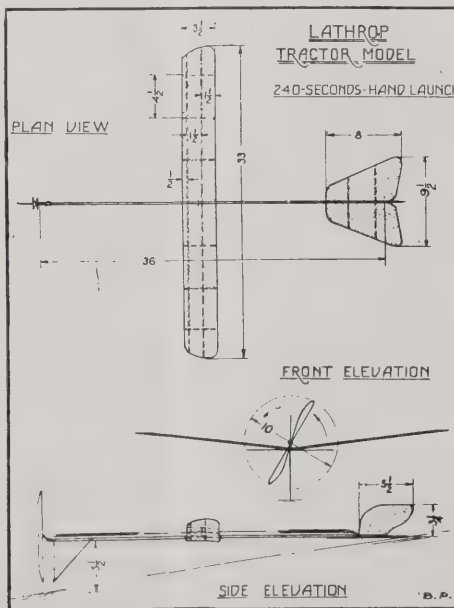
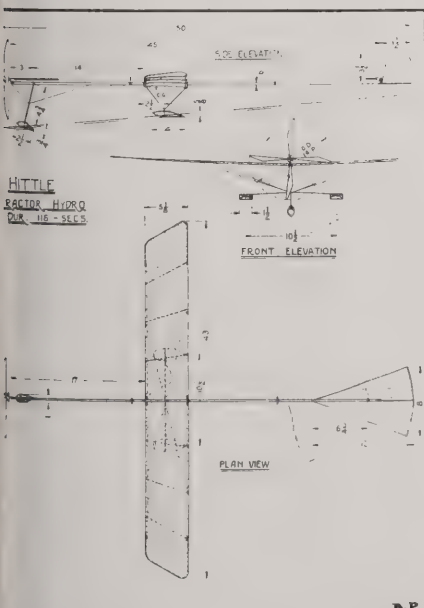
Due to the various classes and kinds of models which have been constructed and presented at competitions, it has become necessary to divide the various classes into groups so that judgment could be rendered on a fair and impartial basis. The following table, having been used successfully by the Norsk Aeromodels Klub, has been approved by the members of the National Scientific Society and is presented to the Model Aircraft clubs for their approval. Suggestions are invited.

Classes	Construction	Hand Launch	Ground Start	Flying after a mark	Circling	Duration of Flight
1. Stick model to 100	40 meters	30 m.	40 m.	$\frac{1}{2}$ Circle	8 sec.	
2. Scale model to 100	30 meters	20 m.	30 m.	$\frac{1}{2}$ Circle	5 $\frac{1}{2}$ sec.	
C. Free class.						
Class A.—Rubber driven stick models. Standard type. Weight of rubber must not exceed 25 grams and rubber length span .85						
must not exceed <u>100</u>						
Class B.—Rubber driven scale models. Standard type. A stick in the fuselage wings or landing are mounted is not allowed. Weight of rubber must not exceed 25 grams and span .85						
length of rubber must not exceed <u>100</u>						
Class C.—Free Class. Record and other models. Power driven.						

Points

1. **Construction.**—The model can be awarded up to 100 points for good construction, exceptional details, etc.
2. **Hand Launch.**—The model is launched from the hand with a slight push in the direction of flight. The Straight line between the starting point and the point where the wheels touch the ground is measured. The minimum yield is awarded 100 points, and each extreme meter is awarded 2.5 points (Class A) and 3.33 points (Class B).
3. **Ground Start.**—The model is started with a slight push. The model must take the air on a starting cloth measuring 5 meters in length. The distance measured is from the end of the cloth to the point where the wheels touch the ground. The minimum yield is awarded 100 points, and each extreme meter is awarded 3.33 points (Class A) and 5 points (Class C).
4. **Flying After a Mark.**—A circle with a radius of 5 meters is measured on the ground. The model is launched from the hand at a distance of 45 meters from the center of the circle. Landing within the circle brings 100 points. Each meter deficient, brings a deduction of 2.5 points (Class A). If the model is one in class "B" a distance of 35 meters from the circle's center is allowed, and each deficient meter brings a deduction of 3.33 points.
(The Norsk Aeromodels Klub has chosen to measure to the point where the Model Stops). The National Scientific Society, in view of the fact that it is extremely difficult to control either a rubber power plant or a compressed-air plant to a definite pitch and time, has chosen to disregard the distance beyond the circle, in the case where the model has passed directly over it.
5. **Circling.**—The model is launched from the hand. The object is to have the model fly as many circles as possible. The minimum yield is awarded 100 points, and each extreme $\frac{1}{4}$ circle is awarded 25 points.
6. **Duration of Flight.**—Time is observed for the practises 2, 3 and 5, the longest duration being valid. The minimum yield is awarded 100 points, each extreme meter being awarded 12.5 and 20 points respectively for Class A and Class B. Time must be measured with the preciseness of $\frac{1}{10}$ of a second.

The partakers may make two attempts in every practice and the best result is valid. The starting rules must be strictly adhered to. A faulty or incorrect start may be declared void. The models must not touch the ground between the starting and landing points. A landing must not assume the character of a down fall and circle flying should not degenerate into a spin. In the event that a model is damaged so that repairs are necessary, five per cent is to be deducted from the sum



Three Record-Breaking Models built by members of the Illinois Model Aero Club, described in last month's "Aerial Age"

of points. All the models in Classes A and B must be furnished with a secured landing-gear.

The foregoing table, compiled by Mr. Harald Gulbrandsen of Kristiana, Norway, applies to models of land planes only. No provision has been made for models of seaplanes or lighter-than-air craft. The members of the N. S. S. are drawing up a set of rules with which, it is hoped, contests for seaplanes and lighter-than-air craft will be encouraged. In the meantime, suggestions are invited. The headquarters of the National Scientific Society are located at Cooper Union, New York City. Mr. J. J. Kuschner is the president.

The Rubber Elastic Motive Power for Models

The use of rubber elastic for the motive power of flying model aeroplanes dates back before the first real flights of man. Choice was not made without good reason, for tests in comparison with all other known sources of power for models placed rubber at the head of the list.

First, let us consider its cost—a really important item, especially for the young experimenter. Compared with the simplest kind of engine, the cost is insignificant. As far as its efficiency as a power-medium is concerned, rubber can absorb a far greater amount of energy, for the same weight of material, than spring steel, because of its greater extension. The handling and “up-keep” of our rubber-motor is extremely simple and economical.

As this source of power has become so widely used, it is well for our experimenters to learn more concerning its natural and mechanical properties, just as the good pilot knows all about the engine he depends on.

Crude rubber is obtained from a large number of different trees, vines and shrubs growing in Mexico, Africa, Java, Sumatra, India, Central and South America. The trees are “tapped” or cut, allowing the milky fluid, called latex, to flow in much the same manner as maple sugar is obtained from the trees in Vermont.

The rubber itself is obtained from the latex by the coagulation process, the principal materials employed being alcohol, acetic acid, air, alum or lime.

Rubber thus obtained in the crude state is purified from mechanical impurities by washing and drying processes, and its preparation for commercial purposes necessitates the use of filling materials called “fillers.” The usual fillers employed are, sulphur, resins, oils, tars, whiting, white lead, talcs, barytes, and clays. Such fillers are used so as to reduce the cost of the rubber without affecting its mechanical properties or usefulness.

Pigments are used in the fillers of colored rubbers, amongst the most used being: lithopone, vermilion, zinc yellow, lamp black, iron oxide, antimony, arsenic and mercuric sulphides, graphite, etc.

Practically all of the commercial rubber is prepared by the vulcanization process, in which the pure or crude rubber is mixed with sulphur and subjected to either heat, acid or cold vulcanization processes.

Crude rubber is a tough, flexible solid, influenced by small changes of temperature, and becoming “tacky” at fairly low temperatures. It melts at about 250° F. and becomes a liquid which does not harden again on cooling. Crude rubber will not dissolve in water or alcohol but dissolves in dilute alkaline solutions, turpentine, petroleum spirits, carbon disulphide and carbon tetrachloride (commonly used in hand fire-extinguishers). Crude rubber is subject to oxidation and it becomes hard and brittle under the prolonged influence of air and light.

Many vulcanized rubbers are affected by the atmosphere and by the action of oils, alcohol, gasoline, etc. They are best stored in a dark place, freely covered with french chalk.

The best grades of rubber have a tensile strength of about 2,000 lbs. per square inch and an ultimate extension of about six times the original length. Good vulcanized rubber can absorb from 500 to 1,000 foot pounds for each pound of its own weight, whereas steel can only absorb from 10 to 20 foot pounds per pound of weight. From this it will be seen why steel springs can never compare with rubber as a source of motive power.

Flat strands of rubber, $\frac{1}{8}$ inch wide and about $\frac{1}{32}$ inch thick are the most popular size used for models. It is usually of very good quality, and a piece one foot long may be stretched to seven feet without breaking, after which it will return to its original length.

Increased Lift Obtained with Curved Wing-Tips

An appreciable improvement in lift and “lift-over drift” may be effected over that of the plain rectangular plan-form of wing with parallel section, by suitably shaping the plan form. The end losses due to “in-flow” near the upper-surface wing tips and to “outflow” near the lower-surface wing tips may be reduced by suitably rounding off the wing tips, in plan form, and by thinning the wing section (or “washing out”) in the front elevation.

The most beneficial effects, however, are obtained only after careful study of the distributions of air pressure and the employment of proper methods of grading in camber, chord and incidence. The coefficient of drift may be reduced considerably by “washing out” the wing tips.

An examination of the wing forms of fast flying birds reveals the fact that they

The Capitol Model Aero Club

Three contests have recently been held by members of the Capitol Model Aero Club at Washington, D. C. While no extraordinary records have been made, the work of the club members has been progressive and is an indication of interesting developments and further progress.

The address of the club has changed from 1726 M St., N. W. to 1210 18th St., N. W., at which place the members have an interesting and comfortable room. All aeromodelists residing in or around the Nation's Capitol are invited to membership.

Mr. Paul Edward Garber is the president of the C. M. A. Mr. Garber is connected with the Division of Mech. Tech. at the Smithsonian Institution, United States National Museum Washington, D. C.

are graded down to very thin pointed sections at the tips. The incidence angle at the tips is usually either zero or negative in value.

Wind tunnel tests on the effect of the shape of wing tips show that the most efficient tip is in the form of a semi-ellipse. For the most part it is undesirable to have as long a tip as is necessitated by an ellipse, and a semi-circular shape is used to good effect.

Design of Boat Hulls and Floats

Flying boat hulls are designed on the general principles of the fast motorboat and hydroplane, the main object being to “hydroplane,” as distinct from ploughing, at as low a water speed as possible. The hull should offer the smallest resistance to water friction and the minimum of wind resistance when in the air. It should be stable, relative to the rest of the machine when floating, when hydroplaning during the take-off, during alighting and when in the air.

Boat hulls or seaplane floats, aside from the considerations of total lightness of the machine, should be light in weight so the center of gravity will not be too low. A low center of gravity makes a machine very unstable in the air and is difficult to balance at all times.

The hull of a flying boat or the floats of a seaplane should be designed for from 2 to 3 times the weight of the machine ready for flight.

Small Balloons Used to Record Temperature of Altitudes

Pressure and temperature measurements of the upper air are made with sounding balloons, which are small balloons inflated with hydrogen and which carry recording instruments. These balloons are arranged to burst at given altitudes, the envelopes acting as parachutes, breaking the fall of the instruments, so that they reach the ground without injury. An addressed label attached to the instruments offer the finder a reward for its return.

Sounding balloons average from 40 inches to nearly 80 inches in diameter. They rise under the influence of their buoyancy and on account of the diminished external pressure, burst at the altitude determined upon beforehand.

In this manner records have been obtained for altitudes up to 23 miles, over 121,000 feet.



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(Concluded from page 442)

More popular, of course, will be the speed of the planes themselves; for the reason that the non-technical public can visualize the strain under which the bodies and wings are laboring, little thinking that the motor is undergoing the same strain, at the same time putting from four to six hundred times the strength of a horse (if it is a big healthy horse) behind the air screw that sends the machines along at, let us say, somewhere in the neighborhood of 200 miles an hour. Reduced to feet, the speed which the Pulitzer entries are expected to average is 300 feet a second. Now, it is generally known that the muzzle velocity of a .45-calibre bullet is approximately 1,200 feet a second. The Pulitzer planes therefore will fly about one-fourth as fast as a .45-bullet. They will make four times the average speed of the Twentieth Century, passing four telegraph poles in the time the fastest train in America requires to pass one.

What's the use of all this? A proper question and an important one. The question is easily answered. Speed is the main essential of a pursuit plane. Without speed a pursuit ship would have nothing to pursue, due to the fact that an enemy would soon pull out of sight or fly round it

in circles until the machine gun found its mark. And the pursuit plane is the most important factor in aerial warfare. The pursuit plane is used for seeking out and destroying the enemy planes, fast or slow; thereby gaining mastery of the air over its sector, and thus being able to protect the slower observation and bombing machines which can perform their duties without fear of interruption.

Every country on earth is developing pursuit machines. The army and navy air forces have not been idle. Still, while foreign nations repeatedly test out their pursuit planes in scheduled Government trials for big prizes, the Pulitzer Trophy Race, which is a civilian contest primarily, affords the only opportunity for the United States Government to determine the relative values of the many experimental types of planes which have been produced in this country during the last two years. All three of our fighting air forces are participating in the Detroit races—the army, navy and marine corps; and each branch without question will know considerably more about its new fighting equipment after October 14th.

(EDITOR'S NOTE.—Colonel Hartney's description of the machines entered in the Pulitzer race will be published in the October number of AERIAL AGE.)

(Concluded from page 445)

170 metric horse-power for 10 meters a second, and roughly 4500 horse-power for 30 meters per second. A tunnel of 5000 or more horse-power might well be recommended.

The first cost of such a tunnel would be of the same order as that of the largest airship shed or astronomical observatory. The cost of operating with very high speeds could be limited by choosing a site near the cheapest source of power. The cost does not seem to be prohibitive either to a nation or to a wealthy patron of science.

The question now raised is as to the value to aeronautics of a full scale wind-tunnel for both absolute and comparative tests. If it be considered very desirable, the representatives of aerodynamics might do well to indicate its advantages. For if the tunnel should appear to be of sufficient importance, the planning and paying for it would perhaps not offer very formidable difficulties. One on a continent would suffice for the present. Various engineers with whom I have discussed the need for a full-scale tunnel are of the opinion that it

(Concluded on page 478)

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(Concluded from page 474)

would be more useful to mankind than another great astronomical observatory, or mammoth airship shed. In fact a large airship shed might be used as the housing for such a tunnel till its permanent value could be ascertained.

A full-scale tunnel would have some obvious advantages. It would furnish a uniform wind throughout the year, irrespective of weather or season. Models and full-scale craft or parts thereof, whether inherently stable or unstable, could be held steady at any attitude to the wind undisturbed by gravity or gusts. The measurements of forces, moments, pressure distributions, flow distributions, could be made under constant conditions and with stationary instruments. Similar models varying greatly in size could be used, thus enlarging the range of v/D . The effect of varying the surface texture, or structural details of full-scale craft, and the effect of ageing and

distortion, could be studied. Laws of comparison between models and full-scale craft could be more exactly established when needed, and in some cases dispensed with by putting the actual ships to direct test.

If an international committee is to consider methods of experimentation, laws of comparison, and forms of expression, it might well include within its scope not only the work of ordinary wind-tunnels but also that of a compressed air tunnel, a full-scale tunnel is possible, and actual flight tests.

(Concluded from page 453)

Such a city as Monmouth, with its spirit of co-operation and enthusiasm for aviation, is a good place in which to manufacture aeroplanes. Negotiations are right now under way to bring to Monmouth the factory of a ship which is destined to be popular.

Detroit was just such a city when the automobile was in the same stage as is aviation today, and the man lacks vision who says that aviation is not destined to be as great an industry as is the automobile today.

(Concluded from page 455)

The introduction of twelve-volt ignition has been a distinct step in advance. Even with the poor batteries which were known to have deteriorated in storage, ignition troubles were practically eliminated. The addition of all the weights to the engine has more than been compensated for by the reduction in the weight of the spares to be carried.

As a general result of the winter work, the Commander of the Air Squadrons is convinced that the improvement in material is such that the time is fast approaching when forced landings and delayed starts can no longer be blamed on material but the responsibility therefor can be placed squarely up to the operating personnel.

The alterations and changes in the Liberty engine which have been effected were under the direction of Lieutenant-Commander S. M. Kraus, and Lieutenant B. G. Leighton of the Bureau of Aeronautics and letters commending their work in this connection have been addressed to them by the Chief of the Bureau.

G. DOUGLAS WARDROP
President and Editor

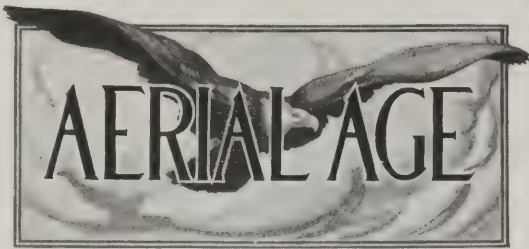
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Associate Editor

WM. H. MILLER, M. Sc.
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G. F. McLAUGHLIN
Technical Editor

NORMAN E. JENNETT
Art Editor

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Advertising Manager



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Bristol

Jupiter Radial Air-Cooled Engine

is the only aero engine in the world which
has passed the Type Tests of both the
British and French Air Ministries

BRITISH AIR MINISTRY TYPE Test, September, 1922

The Jupiter engine was the first air-cooled engine to pass this test, which comprised 50 hours' endurance test at 90 per cent. full power, one hour high speed, one hour high power, runs for power curve, etc. At the conclusion of these tests one hour was run at full throttle at 1,775 r.p.m., averaging 442 B.H.P., and one hour at 1,840 r.p.m., averaging 450 B.H.P.

FRENCH AIR MINISTRY TYPE Test, JUNE, 1922

The tests carried out at Gennevilliers included five non-stop runs of 10 hours each duration, the first half-hour of each period at full power, 9½ hours at 90 per cent. full power, with 2 minutes at full power at the close of each period. The average power recorded at the beginning of the periods was 413 B.H.P., and at the end 420 B.H.P.

The oil consumption was only 10½ pints per hour, and for the first time in the history of the French official tests the whole of the tests were carried out in 10-hour periods without adjustments or replacements of any kind.

The French Official Report States:—

"The 5 tests of 10 hours were carried out without stop of any sort.

"Nothing to report. The engine behaved itself perfectly. There were no replacements of any sort in the course of the trials.

"It is regrettable that this test stops at 50 hours; this duration could have been doubled, which would have been a still better testimony to the engine."

The Bristol Aeroplane Company, Ltd.

FILTON — BRISTOL

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The Detroit Races

ENTRIES ASSURE GREATEST AERONAUTIC EVENT ON RECORD

PRESIDENT Harding has expressed his appreciation of the national importance and significance of the Second National Aero Congress to be held in Detroit and the National Airplane Races to be held at Selfridge Field, Mt. Clemens, October 12, 13, & 14. Howard E. Coffin, Chairman of the National Committee on Organization received the President's letter. It reads:

"I have many times given expression to my interest in the development of aviation. I fully realize the influence which this newest and speediest means of transportation and travel is destined to exert upon civilization.

"Aviation's vitally important part in the general scheme of our own national defense is already well recognized. A strong and healthy commercial aviation development is a prerequisite to all adequate plans involving our national security and welfare.

"Therefore, it is with the greatest satisfaction that I extend to the Detroit Aviation Society and, through your committee, to the National Aeronautic Association my sincere appreciation of the objects you are seeking and my best wishes for the complete success both of the October contests and of the national convention to be held coincident therewith."

Sincerely yours,

(Signed) Warren G. Harding

Fifty-five entries have so far been confirmed in the principal contests for the national races. The large number of entries and the unprecedented preparations being made to accommodate the thousands at Selfridge Field will make the National Airplane Races the greatest and at the same time the most thrilling event in the annals of sport, officials assert.

Delegates from more than sixty cities have made reservations for the air convention.

The Curtiss Marine Flying Trophy Race will be held on October 7th. More than a dozen seaplanes and flying boats have been entered so far in this over-water classic which is the premier event in marine aviation.

On October 12, 13 & 14 a series of races for overland planes will be held, chiefly among them being the PULITZER TROPHY RACE, the speed classic of the world. To date there are twenty-four entries for the Pulitzer contest. It is believed these entries will break the world's record made in last year's Pulitzer race.

All the Executive and Administrative branches of the Government have endorsed these events, the Army, Navy and Marine Corps having entered their latest and fastest planes. Other races will be held for large multi-motored planes, light commercial machines and 2-passenger observation planes.

In all, \$10,000 in money prizes and \$30,000 worth of gold and silver trophies will be awarded.

On the dates of the races for overland planes the Second National Aero Congress will convene. Delegates are being appointed from more than 60 cities in the United States. They will come to Detroit principally to organize a permanent national aeronautic association.

Aviation is the new great arm of the national defense and all Americans are

vitaly interested in this powerful weapon. Then, too, the science of flight is the new medium of travel and transport.

The national aeronautic association will represent all Americans, represent their thought and echo their voice in the halls of the municipal, state and national legislatures.

The delegates to the Second National Aero Congress will draft the constitution and by-laws of this representative organization. Representatives of the National Air Association and the Aero Club of America are co-operating with the advance committee of 500 prominent men in the initial work incident to the organization.

The principal national business to come before the delegates will be the drafting of a program to hasten the adoption of federal air laws and the formation by act of Congress of a bureau of civil aeronautics in the Department of Commerce.

Need for Air Laws

For three or four years Congress has had many measures under consideration, legislation which would place civilian flying under Federal jurisdiction.

The U. S. Army Air Service, the Naval Bureau of Aeronautics and the U. S. Air Mail Service are functioning with an efficiency approximating 100 per cent. They are credited with far-reaching developments in military and naval aerial operations; and are the equal, in many respects superior, to similar air forces abroad. But the military and naval air forces are not handicapped by lack of jurisdiction. Each has its highly trained executive and specialized personnel. That fact accounts for the prestige of American service aviation today.

With civilian aviation it is different. If the public has lost sight of the peaceful attributes of aircraft, it is due for a change of vision. A means of transport which carried more than 150,000 pounds of parcel freight and approximately 250,000 passengers last year must eventually attract sufficient public attention to penetrate the halls of Congress.

Civilian operators, designers and financial supporters of aviation urge the Government to do something to create Federal supervision over civilian flying. For several months this nation-wide demand has been expressed in the Wads-

worth bill.

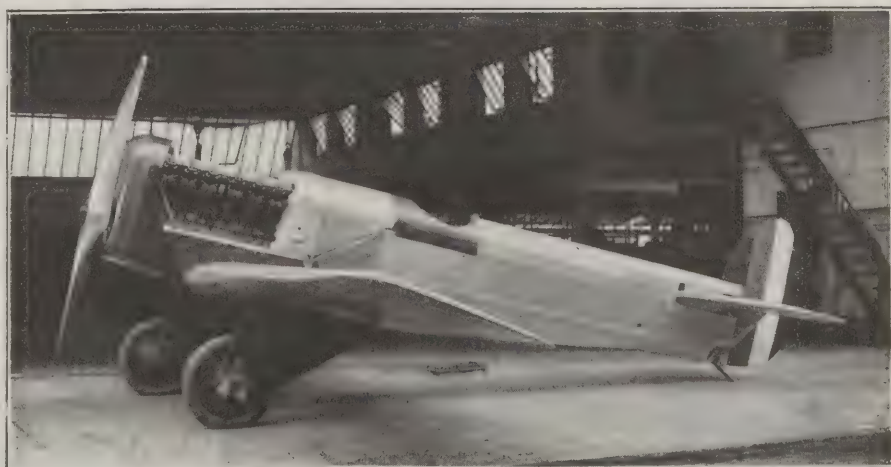
The bill was endorsed by everybody when it was first introduced in the Senate and passed last February. All who had considered the problem approved it; Mayors, State legislatures, flying clubs, State aviation committees and the manufacturers and operators of aircraft. In fact, the aircraft industry is the first infant industry to go on record as desiring to have itself regulated.

Everything Regulated Except Aviation

Operators and constructors have been twixt the devil and the deep blue sea, in a manner of speaking. They have not been controlled by national authority in any form; and after all, control is synonymous with protection. To-day anybody can fly in any sort of an old crate without a license. In a country where one requires a license to hunt, marry, keep a dog, build a house or dig a tunnel, one can do anything he wants to in the air without first qualifying for his job or making his flying machine airworthy.

More than ninety per cent of the aircraft accidents are caused by irresponsible persons operating unairworthy machines. It has led to many serious accidents and has kept capital out of commercial aviation, the sort of aviation that is needed if we are to develop aerial transport facilities to a point where they shall provide an adequate reserve which our excellent Army and Navy air forces may draw upon in an emergency. The Wadsworth bill has been in the House Committee on Interstate and Foreign Commerce since last February. Why it has not been brought out and acted upon, nobody knows.

Meanwhile the aviator is a potential outlaw. For if he damages another's property, falls on him or with him, tears up the grass on a courthouse lawn, in fact, if anything happens that the party of the first part, to wit, the plaintiff, believes should not have happened, the pilot can be prosecuted under the common law, without aerial law, license or legal prerogatives to protect him. Airmen desire wise and strict laws to protect the public, their foolish and erring brethren and themselves. They know their insurance rates will then be reduced.



The Loening Racer, designed by Grover C. Loening.



BRASS

919,569 Pounds for Sale by Sealed Bid
Closing at 12 o'clock Noon May 25th 1922
At Frankford Arsenal, Phila. Pa.

Terms of Sale:
Bids will be received for the entire lot only, and must be accompanied by a certified check or U. S. bonds to the amount of 10% of the bid. The material is loose and is to be sold f. o. b. cars at Westville, N. J.

No guarantee is given as to quality, quantity, analysis, weight or condition and no refund or adjustment will be allowed after award is made. Inspection of the material is invited. Awards will be made within 72 hours after opening of the bids. The Government, however, reserves the right to reject any or all bids.

SEALED bids for the purchase of approximately 919,569 pounds of Brass Extrusion and Regular Caps for caliber .30 cartridge cases, located at the Woodbury Ordnance Reserve Depot, Westville, N. J., will be received by the Philadelphia District Ordnance Salvage Board, not later than 12 noon Thursday, May 25, 1922.

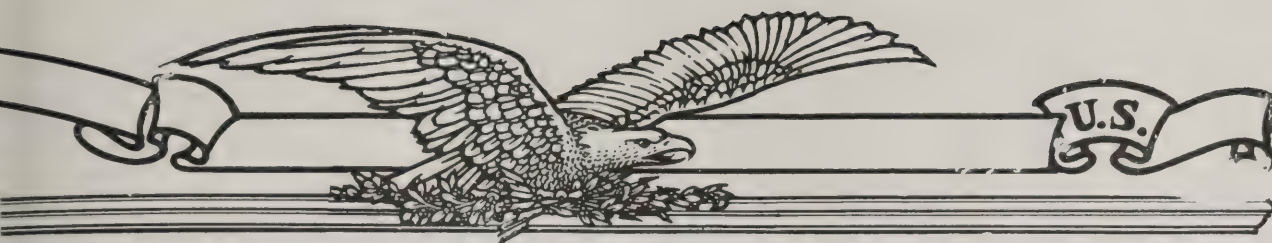
Proposal blanks must be signed in ink by bidders and should be inclosed in a sealed envelope addressed to the undersigned and marked "Bid for the purchase of Brass Extrusion and Regular Caps for Cartridge Cases."

Regular proposal blanks containing complete information as to terms and conditions will be furnished on application to:

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- Q. M. SUPPLIES—Columbus, Ohio, Auction. For catalog write Q. M. S. O., 1819 W. Pershing Road, Chicago, Ill.

FOR CATALOG



Men Have Slaved Years To Make What One of these ads will save you

YOUR favorite paper or business publication will tell you more about how to pay dividends than all the stock selling literature in the world.

Just turn to the War Department announcements of Surplus Property Sales.

You will soon find something you need. And when you do, be sure to send at once for the catalog—for it will point out an opportunity such as has never occurred in the past and is unlikely ever to occur in the future.

These sales cover every conceivable product. Manufacturers can secure machinery, supplies and raw materials. Retailers can secure merchandise of every description. And everything you buy is ready for immediate shipment.

Watch the sales! It's an easy matter to follow the War Department announcements—but not so easy to duplicate the savings they offer. If you want further information, write to J. L. Frink, Chief, Sales Promotion Section, Office, Director of Sales, Room 2515 Munitions Bldg., Washington, D. C.

DEPARTMENT

Rates are now prohibitive.

The aviator points to the motorist who at first fought highway laws, but who now earnestly supports them.

All the great Powers have national air laws except the United States. The Canadian Air Board prohibits flying where the pilot has not been licensed or his plane registered. Pilots are examined and their machines inspected periodically. American pilots are automatically barred from flying over Canadian territory because they are not licensed in this country. The Canadian Air Board, however, has courteously extended permission to our Army and Navy aviators on the grounds that their record proves rigid training and general efficiency.

Races Over Canadian Waters

Two of the courses in the National Airplane Races at Detroit extend over Lake St. Clair, part of which is Canadian territory. Due to our lack of national air laws and the Canadian prescription against our hit and miss civilian flying, civilian entries in the races would be barred.

The Canadian Air Board has been requested to lift the ban for the purpose of the races. Meanwhile strong representations will be made at the Aero Congress asking the legislative branch of the American Government to remedy the situation by the immediate passage of the Wadsworth bill.

The Aero Congress alone would be important, from the national viewpoint, but the National Airplane Races will attract thousands of visitors to Detroit. Official observers are being sent by foreign Governments.

They know that the Army, Navy and Marine Corps air forces, as well as many civilian constructors, have developed nearly forty different types of airplanes in the last two years. The races afford the first opportunity to test these machines under conditions which will disclose their qualities of speed, endurance and all-around efficiency. It is believed that several records will be made as more than a dozen machines are being built for an average speed of 200 miles an hour over a closed course of 160 miles. Several planes are being secretly built, their general specifications remaining a mystery until the rules of the race force the constructors to describe them in official entry blanks.

The Pulitzer Trophy Race, while a contest for the fastest land machines, will be held over a triangular course of 40 miles to a lap (4 laps, or 160 miles) the entire course being over the waters of Lake St. Clair, with the exception of the starting and finishing point at Self-

ridge Field, Mt. Clemens, Mich., where a monster grandstand is being built to accommodate the thousands who usually attend national sporting events. The National Airplane Races this year will be as important as the national motor car races in early days because they will bring out the qualities and defects in the various flying machines. Which is another reason why foreign Governments are watching this year's event so closely.

Notes on Navy's Entries for Detroit Races

Curtiss Marine Trophy Race

Type VE-7H is the standard Vought two-seater advanced training plane now used by the Navy as an observation plane and fitted with a pontoon. This airplane was designed and built by Mr. Chance Vought in 1918 and is supplied as standard equipment to the Atlantic and Pacific Fleet Air Squadrons as a single-seater land plane for combat training, as a two-seater land plane for general observation duty, and as a two-seater seaplane as an observation plane to be carried aboard ship. Vought planes of this type are now on board the MARYLAND and have been successfully launched from the MARYLAND'S catapult. The Wright E-3, 8 cyl. engine is a modification of the standard 180 H. P. E-2 engine made by the same firm, the modifications consisting essentially in high compression pistons, high lift cams and other alterations which permit the engine to develop between 220 and 240 H. P. at 2,000 revolutions. The high compression E-3 engine is designed for blended fuel.

The HA is a Curtiss designed and built seaplane brought out in 1918 as an answer to high performance German seaplanes which were interfering with the bombing operations conducted against the German submarine bases on the Belgian coast. The problem was to develop a fast two-seater seaplane using a single Liberty engine. Due to change in conditions the HA type was never put into production, and the sample plane tested in 1918 has been reconditioned and entered in the Curtiss Marine Trophy Race. Liberty is a standard Liberty engine Liberty engine. A special high compression with high compression pistons and new valves and should develop over 420 H.P. on blended fuel. The machine was designed by Mr. W. L. Gilmor of the Curtiss Aeroplane & Motor Corporation in cooperation with Major B. L. Smith, U. S. Marine Corps.

The H-16 is a standard twin Liberty engined flying boat used during the War both by the American and British Navies

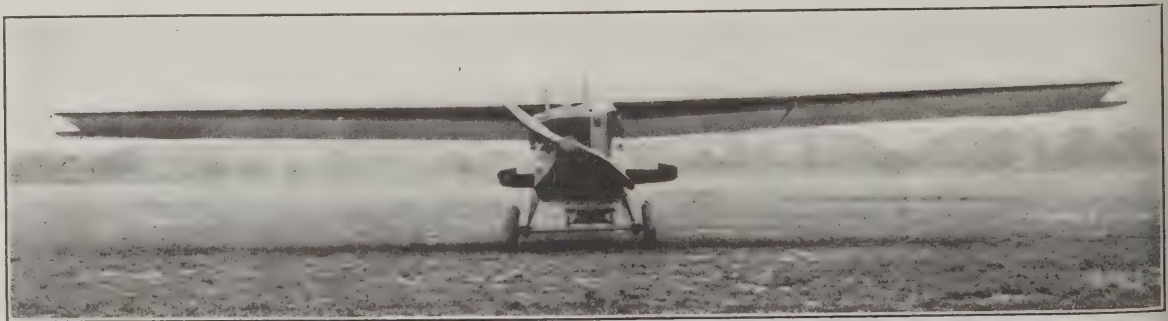
for submarine patrol and convoy duty. The plane was designed by Mr. G. H. Curtiss and built by the Curtiss Aeroplane and Motor Corporation in 1916. The Navy Department has a large number of these planes on hand and the one entered in the race is standard in all respects except the Liberty engines have been provided with special high compression pistons. The H-16 will be flown from the Navy Aircraft Factory to Detroit for the races, following the Hudson River, the Lake Champlain, and the Great Lakes.

The D-4 is a tractor biplane designed by Mr. Edson Gallaudet and built by Gallaudet Aircraft Corporation in 1918. It was built for the Navy as a high speed two-seater seaplane making use of the Gallaudet gear drive. It is believed to be the only gear driven plane in the country and is of considerable technical interest for this reason. It is fitted with a single Liberty engine mounted in the fuselage which drives by means of a ring gear propeller which is situated immediately behind the wings. The fuselage or structure of the airplane extends through the center of the ring gear carrying the propeller.

Model 18-T tractor triplane was designed by Mr. C. B. Kirkham and built in 1918 by the Curtiss Aeroplane and Motor Corporation as a two-seater combat plane of maximum performance. Had the plane continued it is likely that this type would have been put into production for use on the Western Front. As it was, the seaplane made on trials a high speed of 150 miles an hour which was then a world record for any type of airplane and is still believed a world's record for a two-seater fighting machine. For the purpose of the Curtiss Marine Trophy Race, these airplanes which were in storage have been reconditioned and fitted with pontoons to convert them to seaplanes. They are fitted with the Curtiss CC-12, 400 H. P. light 12-cylinder engine especially designed for this airplane. These triplanes are believed to be the only triplanes in the country and are of considerable technical interest on this account.

The UO-1 is a new type of Vought observation seaplane, being developed by the Chance Vought Corporation for the Navy Department as a replacement for the standard VE-7 Vought now used on ship catapult launching. The plane is equipped with the new Aeromarine 250 H.P. engine which presents a new feature in aeroplanes, a light 12-cylinder engine especially designed for heads.

Types TS-1 and 2, and TR-1 and 2, variations of the Navy shipboard observation plane type TS as designed by the Division of the Bureau of Aeronautics.



The Fokker Transport, Entered by the Army in Event No 3.

It at the Naval Aircraft Factory. The planes were designed to give the small and most compact plane with the maximum facilities for take-down and erection aboard ship. All wires and turnbuckles in the wing bracing are eliminated to facilitate rapid erection. The fuel tank is carried in the lower wing and is made accessible so that in case of fire, due to incendiary bullet, the pilot can pull a release which will drop the tank and its inflammable contents clear of the machine. Another unique feature is the provision of interchangeable landing gears so that TS planes may be used with land wheels as an ordinary land plane, or with pontoons as a seaplane depending on the service required. The TS-1 is equipped with a new Lawrence air-cooled engine rated at 220 H.P. This is the last word in air-cooled engine development and the Race is considered an excellent place to give this engine a severe try-out. The engine has been developed for the Navy especially for the problem of board airplanes where minimum weight and the greatest simplicity are prerequisites. The TS-2 is the same plane equipped with the Aeromarine 240 H.P. engine. The TR-1 is the same TS plane provided with a Lawrence air-cooled engine, but given special racing wings, and the TR-3 is the same as the TR-1 except that Wright E-2, 220 H.P. engine has been substituted. These four planes constitute then a full-scale experiment of the greatest technical interest to the Navy, using three different engines and two different designs of wing. The occasion of the Curtiss Marine Trophy Race has been used to try out these design modifications under competitive conditions. The planes include a maximum of new and advanced features both in engineering and aerodynamics, and it is believed that the race between these four planes is secondary in interest only to the race for the Curtiss Marine Trophy for which they will compete.

Pulitzer Race

The CR biplanes are well known since one of them piloted by Mr. Bert Acosta won the race for the Pulitzer Trophy at Ohio last year making a speed of 176.7 miles per hour, the World's Record for a closed course. The same plane tried over a straightaway has made 197.8 miles per hour, which is an American speed record and is not a World's Record for straight flight.

The CR type was designed by the Curtiss Aeroplane & Motor Corporation in cooperation with the Navy Department and built by that corporation in an effort to produce an airplane with the maximum aerodynamic refinement. The CR planes are equipped with a Curtiss 12-cylinder, 400 H.P. engine which is still a relatively new engine developed by the Curtiss Company for the Navy Department, but not yet in general service use. The information obtained by testing this engine in the CR is being applied in the form of modifications to the sample engine, before such engines are adopted for general service. The CR machine, as the present holder, is of course the favorite based on past performance. It is the first airplane in this country to have attained speeds above 190 miles and it is due largely to the special wing construction and the fact that no difficulties were experienced. Abroad in connection with racing there has been a succession of wing failures in the air largely due to fabric tearing loose under the action of terrific

pressures generated at these speeds. However, the CR plane has its wing covered with plywood to which the fabric covering is glued and ironed in place so that there is no possibility of it working loose.

The BR type airplanes are designed by Messrs. Booth and Thurston of the Aerial Engineering Corporation, Hammondsport, N.Y., who a year ago were employees of the Curtiss Aeroplane and Motor Corporation and worked on the design of the CR plane. Therefore, it may be concluded that the BR will incorporate a good deal of the experience of the CR type. The BR represents an attempt to take another step in the matter of aerodynamics refinement suppressing completely the structural bracing required by wings of a biplane by the use of an unbraced monoplane wing. In addition, there is a retracting land gear by which the entire landing gear is retracted into the body of the fuselage once the plane is in the air so that in flight only the fuselage and wings present resistance to the air. These are radical innovations in the art of airplane design and if successful should materially increase the speed that airplanes are capable of making today. A further innovation of a frankly experimental character has been tried on one of the BR planes and this is the complete suppression of the radiator which all water-cooled engines have to have carried for them. This is done by covering the entire wing with a thin sheet of copper under which the water circulates so that the wing itself becomes one large radiator performing the double function of cooling the engine and supporting the weight of the plane. If it be proved possible by the gruelling conditions of a race to cool the engine developing its ultimate maximum of power a very important advance in aeronautical engineering will have been made. In general, the BR air planes represent in their design and construction not only the last word in refinement, but three radical innovations in design which, if successful, will have a profound influence on the future design of high performance military and naval airplanes. The BR planes are fitted with the Wright H-3 special high compression engine developing 400 H.P.

The MB-7 is a tiny monoplane designed and built for the Navy by the Thomas-Morse Company for the Pulitzer Race of last year and, although this little airplane did not finish the race due unfortunately to a forced landing in which Col. Hartney, who was flying the plane for the contractor, was injured, it nevertheless gave a very good account of itself and it is proposed to enter the machine again in this year's race. The MB-7 is equipped with the special 400 H.P. Wright H-3 engine that is also used in the BR plane. The MB-7 does not present any radical features, but is a conventional monoplane of the very minimum size to carry this large engine and speed is obtained by a low power-weight ratio.

No. 1.

Many Entries For Event

Curtiss Marine Flying Trophy

VE-7H	Tractor Biplane	VF Class
Span—upper and lower—34' 1 3/8"		
Length—30' 1"		
Height—10' 2"		
Chord—4' 7 1/2"		
Gap—4' 8"		
Angle of Incidence—Upper 1° 45', Lower 2° 15'		
Dihedral 1° 15'		
Wing Area—284.5sq. ft.		
Aerofoil Sec. R.A.F.—15		

Gross Weight—2175
Maximum Speed—120

Engine—Wright E-3, 220 H.P.

Designed—by Mr. Chance Vought.

Built by Chance Vought Corporation.

Pilot: H. A. Elliot, Lieutenant, U.S.N.

TS-2	Tractor Biplane	VF Class
------	-----------------	----------

Span—upper and lower—25' 0"
Length—24' 7"
Height—9' 6 3/4"
Chord—4' 9"
Gap—5' 6"
Angle of Incidence—0
Dihedral—3° (lower wing only)
Wing Area—225 sq. ft.
Aerofoil Section—USA—27
Gross Weight—2085
Maximum speed—130

Engine—Aeromarine U—8—D, 240 H.P.

Designed by Design Section, Bureau of Aeronautics, Navy. Department. (Comdr. Hunsaker).

Built by Naval Aircraft Factory.

Pilot: H. J. Brow, Lieutenant, U.S.N.

TS-1	Tractor Biplane	VA Class
------	-----------------	----------

Span—upper and lower—25' 0"
Length—24' 7"
Height—9' 6 3/4"
Chord—4' 9"
Gap—5' 6"
Angle of Incidence—0
Dihedral—3° (Lower wing only)
Wing Area—225 Sq. ft.
Aerofoil Section—USA—27
Gross Weight—2025
Maximum Speed—125

Engine Lawrence J—1, 220 H.P.

Designed by Design Section, Bureau of Aeronautics, Navy Dept., (Comdr. Hunsaker)

Built by Curtiss Aeroplane & Motor Corp.

Pilot: S. W. Callaway, Lieut. (jg) U.S.N.

TR-3	Tractor Biplane	VF Class
------	-----------------	----------

Span—upper and lower—25' 0"
Length—24' 7"
Height—9' 6 3/4"
Chord—4' 9"
Gap—5' 6"
Angle of Incidence—0
Dihedral—3° (lower wing only)
Wing Area—225 sq. ft.
Aerofoil Section—Mod. RAF—15
Gross Weight—1980
Maximum speed—130

Engine—Wright E—3, 220 H.P.

Designed by Design Section, Bureau of Aeronautics, Navy Dept. (Comdr. Hunsaker).

Built by Naval Aircraft Factory.

Pilot: D. Rittenhouse, Lieutenant, U.S.N.

TR-1	Tractor Biplane	VF Class
------	-----------------	----------

Span—upper and lower—25' 0"
Length—24' 7"
Height—9' 6 3/4"
Chord—4' 9"
Gap—5' 6"

Angle of Incidence—0
 Dihedral—3° (Lower wing only)
 Wing Area—225 Sq. ft.
 Aerofoil Section—Mod. RAF—15
 Gross Weight—1790
 Maximum Speed—130
 Engine—Lawrence J—1, 220 H.P.
 Designed by Design Section, Bureau of Aeronautics, (Navy Dept., (Comdr. Huusaker)
 Built by Naval Aircraft Factory.
 Pilot: A. W. Gorton, Lieutenant, U.S.N.

HA Tractor Biplane VF Class
 Span—upper and lower—42' 0"
 Length—30' 9"
 Height—11' 5"
 Chord—6' 2"
 Gap—6'

Angle of Incidence—0
 Dihedral—0
 Wing Area—490 sq. ft.
 Aerofoil Section—Sloane
 Gross Weight—3906
 Maximum speed—135
 Engine—Liberty Special H.C., 470 H.P.
 Designed by Curtiss Aeroplane & Motor Corp. (Mr. W. L. Gilmor)
 Built by Curtiss Aeroplane & Motor Corporation.

Pilot: A. J. Williams, Ens., U.S.N.
H-16 Tractor Biplane VP Class
 Span—Upper 95' 1", Lower 68' 11"
 Length—46' 2"
 Height—17' 9"
 Chord—7' 1"
 Gap—8' 1"

Angle of Incidence—4°
 Dihedral—1°
 Wing Area—1164 sq. ft.
 Aerofoil Section R-14—6
 Gross Weight—10000
 Maximum Speed—100
 Engine—Liberty Special H. C., 420 H. P. engine
 Designed by Curtiss Aeroplane & Motor Corp. (Mr. G. H. Curtiss)
 Built by Curtiss Aeroplane & Motor Corp.
 Pilot: R. Irvine, Lieutenant, U. S. N.

D-4 Tractor Biplane VF Class
 Span—Upper, 46' 5", Lower 45'
 Length—33' 6"
 Height—11' 8"
 Chord—7'
 Gap—7'

Angle of Incidence—2° 10'
 Dihedral—0
 Wing Area—620 sq. ft.
 Aerofoil Section RAF—15
 Gross Weight—5440
 Maximum speed—135
 Landing speed—55
 Trial Report—No. 5, dated Feb. 1919.
 Engine—Liberty Special H.C., 420 H.P.
 Designed by Gallaudet Aircraft Corp. (Mr. Edson Gallaudet)
 Built by Gallaudet Aircraft Corp. (about first of 1918)
 Pilot: W. K. Patterson, Lieutenant, U.S.N.

18-T Tractor Triplane VF Class
 Span—Upper, Lower and Middle—40' 7½"
 Length—28' 3⅞"
 Height—12'
 Chord—3' 6"
 Gap—Upper 3' 6", Lower 2' 11"

Angle of Incidence—2½°
 Dihedral—0
 Wing Area—400 sq. ft.
 Aerofoil Section—Sloane
 Gross Weight—3972
 Maximum Speed—140
 Engine—Curtiss C-D-12, 400 H.P.
 Designed by Curtiss Aeroplane & Motor Corp. (Mr. C.B. Kirkman)
 Maximum Speed—120
 Wing Area—284.4 sq. ft.



Lt. O. G. Kelly, who will pilot the Fokker Transport

Aerofoil Section—RAF—15
 Gross Weight—2175
 Built by Curtiss Aeroplane & Motor Corp.
 Pilot: T. B. Lee, Lieutenant, (jg) U.S.N.

18-T Tractor Triplane VF Class
 Span—Upper, Lower and Middle—40' 7½"
 Length—28' 3⅞"
 Height—12'
 Chord—3' 6"
 Gap—Upper 3' 6", Lower 2' 11"

Angle of Incidence—2½°
 Dihedral—0
 Wing Area—400 sq. ft.
 Aerofoil Section—Sloane
 Gross Weight—3972
 Maximum speed—140
 Engine—Curtiss C-D-12, 400 H.P.
 Designed by Curtiss Aeroplane & Motor Corp. (Mr. C.B. Kirkman)
 Built by Curtiss Aeroplane & Motor Corporation.
 Pilot: L. H. Sanderson, 1st Lieut. U.S.M.C.

VO-1 Tractor Biplane VO Class
 Span—Upper 34' 1⅜", Lower 34' 1⅜"
 Length—29' 3"
 Height—10'
 Chord—6'
 Gap—4' 8"
 Angle of Incidence—0
 Dihedral—0
 Wing Area—308 sq. ft.
 Aerofoil Section—Albatros.
 Gross Weight—2608
 Maximum Speed—130
 Engine—Aeromarine U—873, 250 H.P.
 Designed—by Chance Vought Corporation. (Mr. Chance Vought.)
 Built by Chance Vought Corp.
 Pilot: M. A. Mitscher, Lieut. Comdr. U.S.N.

Navy Entries For Event No. 4

VE-7-H Tractor Biplane VA Class
 Span—Upper and Lower—34' 1⅜"
 Length—30' 1"
 Height—10' 2"
 Chord—4' 7½"
 Gap—4' 8"
 Angle of Incidence—Upper 1° 45', Lower 2° 15'
 Dihedral—1° 15'
 Wing Area—284.4 sq. ft.
 Aerofoil Section—RAF—15

Gross Weight—2175
 Maximum Speed—120
 Engine—Wright E-3, 220 H.P.
 Designed—by Chance Vought Corporation. (Mr. Chance Vought.)
 Built by Chance Vought Corp.
 Pilot: H. A. Elliot, Lieutenant, U.S.N.

Tractor Biplane

Span—Upper and Lower—22' 8"
 Length—20' 9"
 Height—8' 0"
 Chord—4' 0"
 Gap—4' 0"
 Angle of Incidence—0
 Dihedral—2° (Lower wing only)
 Wing Area—168
 Aerofoil Section—Sloane
 Gross Weight—2095
 Maximum Speed—186
 Stalling Speed—65
 Trial Report,—No. 115, dated March 1922.

Engine—Curtiss D—12, 400 H.P.
 Designed by Curtiss Aeroplane & Motor Corp. (Messrs. Gilmor, Booth & Thurston).
 Built by Curtiss Aeroplane & Motor Corp.
 Sept. 1921.
 Pilot: F. Fechteler, Lieutenant, U.S.N.
 or H. J. Brow, Lieutenant, U.S.N.

Tractor Monoplane

Span—28' 1"
 Length—21' 1¼"
 Height—6' 4 1/2"
 Chord—2' at tips to 6' at fuselage
 Gap—0
 Angle of Incidence—0
 Dihedral—3 1/1°
 Wing Area—104
 Aerofoil Section—Gottengen No. 387
 Gross Weight—2020
 Maximum speed—190
 Stalling Speed—70
 Engine—Wright H-3, 400 H. P.
 Designed by Aerial Engineering Corp. (Messrs. Booth & Thurston)
 Built by Aerial Engineering Corp.
 Pilot: S. W. Calloway, Lieut. (jg) U. S. N.

Tractor Monoplane

Span—28' 1"
 Length—21' 1 1/4"
 Height—6' 4 1/2"
 Chord—2' at tips to 6' at fuselage
 Gap—0
 Angle of Incidence—0
 Dihedral—3 1/2°
 Wing Area—104
 Aerofoil Section—Gottengen No. 387
 Gross Weight—2020
 Maximum Speed—190
 Stalling Speed—70
 Engine—Wright H-3, 400 H. P.
 Designed—by Aerial Engineering Corp. (Messrs. Booth & Thurston)
 Built by Aerial Engineering Corp.
 Pilot: David Rittenhouse, Lieut. U. S.

Tractor Biplane

Span—Upper and Lower—22' 8"
 Length—20' 9"
 Height—8' 0"
 Chord—4' 0"
 Gap—4' 0"
 Angle of Incidence—0
 Dihedral—2° (Lower wing only)
 Wing Area—168
 Aerofoil Section—Sloane
 Gross Weight—2095
 Maximum Speed—186
 Stalling Speed—65
 Trial Report, —No. 115, dated March 1922.
 Engine—Curtiss CD-12, 400 H. P.
 Designed by Curtiss Aeroplane & Motor Corp.

The National Airplane Races this year will be as important as the National Motor Car Races in the early days, because they will bring out the qualities and defects in the various flying machines. The main event will be the Pulitzer

Trophy Race, a contest for the fastest land machines, which will be held over a triangular course totalling 160 miles (4 laps of 40 miles each), the entire course being over the waters of Lake St. Clair, with the exception of the landing and

finishing point at Selfridge Field, Mt. Clemens.

The Army pilots and alternates, and the machines they are to fly, are as follows:

Army Entries in Pulitzer Race

Events	Type	Pilot	Alternate
Event No. 2. Large capacity multi-motored airplanes	L. W. F. "Owl" Martin Bomber " " " Martin Transport	Lt. Ernest E. Harmon Capt. W. R. Lawson Lt. Chas. M. Cummings Lt. Gerald E. Ballard Lt. Phillip Melville Lt. Erik H. Nelson	Lt. Leslie P. Arnold Lt. Raymond E. Davis Lt. Levi L. Beery Lt. Chas. B. Austin Major John H. Pirie
Event No. 3. Light Commercial airplanes	Fokker Transport DH4B	Lt. O. G. Kelly Lt. Harold R. Harris	Lt. R. S. Worthington Major Fred H. Coleman
Event No. 4. Observation type, 2-passenger airplanes	DH4B " " LePere XBLA "	Lt. Benj. R. Morton Lt. James D. Givens Lt. Warren R. Carter Maj. Follett Bradley Lt. T. K. Koenig Lt. Wm. L. Boyd Lt. Dale V. Gaffney Capt. Lloyd L. Harvey	Lt. Frank M. Paul Capt. Ernest Clark Lt. Edwin B. Robzien Major F. L. Martin Lt. John W. Monahan Lt. Geo. W. Goddard Lt. Delmar H. Dunton Lt. Howard K. Ramey
Event No. 4. High Speed Pulitzer	VCP-1-600HP " Curtiss CD12 375 hp " " Loening, 600 h. p. " " Thos. Morse, 600 hp " " Sperry, 350 h. p. " " " " M. B. 3 " " "	Lt. C. S. Moseley Lt. R. L. Maughan Lt. L. J. Matland Lt. E. C. Whitehead Lt. L. D. Schulze Capt. F. O. D. Hunter Lt. C. L. Bissell Lt. E. H. Barksdale Capt. St. C. Streett Lt. F. B. Johnson Capt. Burt E. Skeel Lt. Benj. K. McBride Lt. Donald F. Stace Capt. H. M. Elmendorf Capt. Oliver W. Broberg Lt. James D. Summers	Lt. L. Wade Lt. Bushrod Hoppin Lt. C. V. Haynes Lt. G. P. Tourtellot Lt. J. T. Hutchison Lt. C. E. Crumrine Lt. T. K. Matthews Lt. G. C. McDonald Lt. V. S. Miner Lt. K. N. Walker Capt. Albert M. Guidera Lt. Walter H. Reid Capt. Vincent B. Dixon Lt. Roy P. Mosher Lt. Hobert R. Yeager Lt. Roy W. Camblin

Detroit-Cleveland Flying Boat Line Carrying Many Passengers

With the starting of a double daily flying boat service between the two lake cities by the Aeromarine Airways a new chapter in the development of commercial aviation in America has commenced.

Every day, promptly at 9 A.M., one of the Aeromarine eleven passenger enclosed-cabin flying limosines leaves the airport in Detroit for Cleveland, and in the latter city another flying boat of the same type takes the air bound for Detroit. The return flight is made from both cities at 5 P.M. The flying time in this division of the Aeromarine Airways is 90 minutes as compared to 5 hours of the train.

The fare is \$75 round trip and \$40 one way. C. F. Redden, president of the company, through whose efforts the airway was established, stated today that as the volume of passenger traffic grew so would the rate of fare be reduced.

So popular has this new mode of travel between Detroit and Cleveland become that reservations have to be made several days in advance if seats are desired. On Fridays and Saturdays it is almost impossible to secure

seats unless ample advanced notice is given the company. Four huge flying boats are used on this service. They are the famous "Santa Maria," holder of the world's record for distance flown, the "Wolverine," the "Buckeye" and the "Niagara."

The equipment at both the Detroit and Cleveland terminals is complete in every way. A luxurious house boat, from which passengers are taken aboard the flying boats, a speedy and comfortable motor launch and automobile parking space at the landing docks make air travel via Aeromarine flying boats comfortable from the moment the ticket is collected at the terminal until the passenger arrives at his destination.

As the crow flies, the distance between cities is 112 miles and an elaborate and carefully planned method of communication has been established through signal stations, en route. When the morning boat leaves Detroit, at the main operating base, it flies down the Detroit River and lands at the foot of First Street in the heart of the downtown business section where additional passengers are taken aboard. Taking the air once more the flight is continued over the river until Lake Erie is reached.

At the mouth of the Detroit River is a signal tower and the exact time the flying boat passes is immediately telephoned back to Detroit. There are other signal stations en route, at Put-In-Bay, Vermillion, O., and Lorain, O. and the same procedure is followed.

With this method the boats are under constant observation and the exact time of their arrival can be announced at the dock a half hour before the flying boat arrives.

The schedule has been maintained without interruption since the service was started and in nearly every case the boats arrive on time. In the matter of departures also the strictest attention is paid to getting the boats away on time and already several tardy passengers, arriving a few minutes late, have been forced to realize that when a departure time is set the boat departs promptly.

Each seat in the beautiful enclosed-cabins is numbered and every passenger knows beforehand just where he will sit. This avoids unnecessary delay and confusion and prevents misunderstanding among those making the flight.

Landing Field Buildings

Types, Sizes and Cost of Buildings for Civil Aeroplane Landing Fields.

By Archibald Blank, Consulting Engineer, Garden City, N.Y.

Size of Hangars

THE sizes and shapes of hangars to be used depend entirely upon the size of machines, the operating practice and the importance of the fire risk. Before the kind of buildings to be used is decided, each of these points should be carefully considered. Information on the dimensions of the machines, likely to be used at the field, should be obtained and tabulated before any other step is taken. Construction of hangars without first assembling this data may result in either great waste of space or in the provision of hangars in which some machines arriving at the field cannot be housed. Obvious though this should be, it is quite often neglected. Table 1 gives the housing dimensions of a wide range of machines, water and land types, including military, sport and commercial. These can probably be regarded as representative of the machines likely to land at a municipal or other field in the United States.

One of the next points to be considered is the question of whether individual hangars are to be used or whether several machines are to be housed in each hangar. The former method is preferable, but has the disadvantage of requiring greater investment in buildings. The latter is more economical in cost, but increases the possible loss in the event of fire. In addition, if the hangar is to be much longer than it is wide, it will be impossible to remove machines housed in the rear without moving those nearer the door. It is this consideration which makes the deep Army hangars unsuitable for civil purposes. Where hangars are to be leased to several different parties, the single machine type of hangar is particularly desirable on account of its keeping the property of each lessee separate.

If only one machine is to be housed in each hangar, and the maximum size is definitely known, a hangar can be selected which permits the housing of this machine with a minimum clearance for each side, front and rear of 2 to 5 feet, depending upon the size of the machine. The door should be of such size as to clear the highest part of the machine (with propeller swung out of the way), with tail either up or down, by not less than 12 inches. Where more than one machine is to be housed in one han-

gar, scale paper layouts of the machines to be housed should be made and several arrangements tried on paper until the most economical use of space is determined. Ample clearances should be allowed to permit moving of machines. It is advisable to consider only the use of standard sizes of hangars unless the project is an extremely large one requiring a complete chain of fields. Table 2 gives the dimensions of most of the standard hangars which can be obtained in this country.

Types of Hangars

Generally speaking, hangar construction may be divided into five classes. Arranged in the order of their usual cost these are: (1) tent; (2) canvas on rigid frame, usually of wood; (3) all wood; (4) all steel and (5) the factory type of brick, steel and glass with timber roofing. The tent hangar is simply a temporary housing, being a canvas tent shaped to house the aeroplane. It should not be considered for any other purpose than emergency housing. Its value even as a temporary hangar is to be questioned. The second type, canvas on wood frame, is also temporary and more or less of a makeshift at best. Contrary to a quite general impression, it is not practicable to erect this type and later replace the canvas with wood. The frame is very light and will not carry the additional weight of the wood siding and roof.

The all-wood hangar can be regarded as a permanent type of construction and has been used to quite some extent in this country. It was, in fact, the first type to be used. This type is, however, rapidly being supplanted in public favor by the all-steel type, which has the advantage of being a lesser fire hazard. This change is due to the standardization of the

steel hangar having brought its cost down to the point where it is comparable with wood and sometimes lower. The factory type of building being the most expensive type of construction, the all-steel may be regarded as the most generally suitable for hangar purposes. Table 3 gives the approximate costs, per square foot of floor space, of the construction of the various types of hangar shop and other buildings in the eastern part of the United States. The costs are compiled with great care and can be relied upon, subject to the usual fluctuation in building costs. A substantial reduction in outlay will be obtained if the aeroplanes are finished sufficiently to withstand exposure and are stored by being fastened down to the field with cockpit engine, propeller, etc., covered with tarpaulins. The only hangars required will be such as are necessary for shop purposes and to house machines on which work is being done. It should be remembered that aeroplanes should be specially weather-proofed if this practice is to be used. Another method of reducing the building investment, but which is not always practicable, is to construct hangars shaped to fit the machine instead of being rectangular. This gives a building of T-shape, plan, and, while costing more per square foot of floor, the cost per machine is slightly reduced.

Types of Hangar Floors

Four types of floors for hangars have been in general use to date. These are: (1) dirt; (2) cinder; (3) wood and (4) concrete. The first is entirely unsuitable and is really no floor at all. The second, properly laid and rolled, is very economical and quite satisfactory for hangars

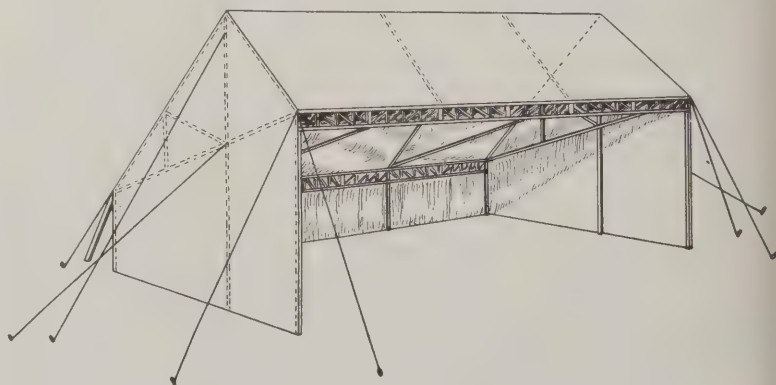


Fig. 1: Wood and Canvas Hangar Richards



Fig 2: All Steel Hangar (Milliken) with Curtain Doors

much as shops. It also has the advantage of absorbing gasoline or while providing a firm footing. While it gradually hardens with use, the surface can be restored by applying and rolling a couple of inches of additional cylinders when necessary. The last two types of floor are each satisfactory so far as performance is concerned, but are expensive and should not be considered for most hangar purposes on this account. They are, however, more suitable for floors than the cinder type. The former floor is constructed by spreading clean cinders over the surface of the earth inside of the building and rolling down until firm. The finished floor should be about 6 inches thick, which will require about 9 inches of cinders to be spread before rolling. The 6 inches of finished floor is the level sufficiently above the surrounding soil to ensure dryness in most cases. It may sometimes be necessary to increase this depth if the surrounding soil holds much water. This increased height can be obtained economically by filling in and rolling several inches of soil before spreading the cinders. A finished floor elevation of, say, 12 inches thus obtained can be relied upon to keep the building dry even if the surroundings are damp. Table 4 gives the approximate cost of construction for different types of floors in the eastern part of the United States. Such costs are subject to considerable variation according to local labor conditions and cost of materials. However, the figures given are sufficiently accurate for all preliminary estimate purposes.

Hangar Doors

The most important single feature of hangar construction is the door through which the aeroplanes are moved. Several types of hangar doors are shown in Figure 5. The horizontally hinged type have been found to operate well when new, but they do not stand up under rough constant usage. As landing field

equipment is exposed to high winds, as well as being usually neglected, these types should be regarded as unsuitable on account of their liability to damage. The curtain type of door is, by far, the most economical so far as initial cost is concerned. While it requires some care also, and must be securely tied at all times, it has the advantage of being easily repaired and stands up fairly well. Where funds are limited this type of door should be used, excepting in localities where very high winds are frequent. When such doors are installed a rule should be made of always fastening the curtain whether open or closed.

The folding type and the rolling type of doors are each very satisfactory, but fairly expensive. They require less maintenance than the curtain door and are therefore cheaper in the end. For all ordinary purposes these doors can be generally recommended. The bascule door, motor operated, is probably the very best type of hangar door used. It is, naturally, the most expensive. The rolling steel shutter type of door is also a very good door, but an expensive one. It is not so convenient to operate as the bascule type, even if power for operation were to be furnished. The limits in the practical

widths of the steel rolling shutters necessitates there being several of these used to close the ordinary hangar opening. This, at the same time, requires the use of folding guides which have to be swung out of the way after the shutters are raised. Whether the additional expense of these latter types of doors is justified will depend upon the particular project.

Shops and Garages

No trustworthy general rules can be laid down for the area of shop and garage space which is required at any field for a given number of aeroplanes. The Army and Navy field conditions are so different from those found at civilian fields that any figures from such sources would only be misleading. In the case of fields where hangars are provided for all of the aeroplanes, the question of shop space may usually be considered to be taken care of in the hangars themselves. There will be sufficient clear space around the machines to provide room for work benches, etc., for the repair work. There will be some exceptions to this, however. In the case of organized airlines, repair work will probably be concentrated in one building on each field in the interest of efficiency. Also in cases where the practice of fastening aeroplanes down to the field, instead of housing them, is used, one shop building of the hangar type will be necessary. In the latter case, if this building is large enough to house the largest aeroplane at the field, it can be used both for small work and assembly purposes. With civilian fields of the present capacity, this one building will be found to be amply sufficient. In the case of organized airlines no general rules can be given; each case must be worked out in detail to suit conditions.



Fig. 3: Steel frame hangar with corrugated asbestos sides and roof, and with motor operated Bascule door (Straus)

The garage space necessary is subject to similar variation. In this case the best policy is probably to set aside a convenient plot for the future garage and to erect no buildings for this purpose until actually required. When the need arises, a standardized steel building meeting immediate needs should be erected, leaving space for expansion at the side and in the rear. As expansion became necessary, additional sections could be added to the original building, the former side or rear end covering being moved to the new side or end of the structure.

Wood flooring is much to be preferred for the shop buildings. For an assembly shop a cinder floor is quite usable, but not so satisfactory as the wood. For other shops the wood is the only really suitable floor. The planked wood floor can be considered as the most suitable for general shop purposes, while the wood block floor is most satisfactory for machine shops, engine overhaul and similar shops. For garage purposes the concrete type of flooring is the most suitable, but cinder floors are also satisfactory. The use of any type of wood floor for garage purposes is not advisable. All shops should be well

Table 1—Housing dimensions of typical aeroplanes (to nearest inch)					
Make and Model	Width Overall		Length	Height with Propeller Horizontal	Type
	Wings on	Folded or Wings off			
LAND MACHINES					
Air Service Messenger.....	20' 0"	7' 0"	17' 9"	7' 0"	Sport or messenger
Thomas-Morse MB-7.....	24' 0"	8' 0"	18' 6"	7' 3"	Scout
Curtiss Oriole.....	40' 9"	10' 11"	26' 1"	10' 3"	Sport
DH-4.....	42' 6"	13' 7"	29' 11"	9' 8"	Fighter
Curtiss JN-4.....	43' 7"	9' 9"	26' 11"	9' 10"	Training
Curtiss 1-Engine Eagle.....	64' 4"	17' 6"	37' 3"	13' 6"	Commercial-passenger
G. L. Martin MB-2.....	74' 2"	37' 10"	43' 7"	15' 7"	Bomber
WATER MACHINES					
Loening Model 23.....	43' 0"	10' 0"	33' 0"	8' 9"	Sport
Aeromarine Series 40 and 50.....	48' 6"	11' 0"	28' 11"	12' 7"	Sport
Curtiss Seagull.....	50' 3"	11' 11"	28' 10"	11' 9"	Sport
Curtiss HS-2, Aeromarine 80.....	74' 0"	15' 1"	38' 6"	14' 7"	Naval passenger
Navy F-5-L, Aeromarine 75.....	103' 9"	19' 6"	49' 4"	18' 9"	Naval passenger

NOTE: Add 12" to 24" to height of water types to allow for height of handling truck.

lighted, both naturally and artificially. These buildings, or parts of buildings, should be heated in cold weather, otherwise the working efficiency of the staff may be expected to drop very greatly. Toilet facilities should be provided for each building if large and for each group of buildings if small. There should be modern equipment if running water is available, otherwise outhouses should be constructed in convenient locations. So far as the type of construction is concerned, shop buildings may be similar to the hangar buildings. Standardized steel buildings are particularly

suitable for garage use. Dope rooms in shops should be separated, by partitions, from the rest of the building in which they are located. Storage rooms should also be well ventilated directly to the outer air. If mending is to be done, this ventilation should be obtained by the use of exhaust fans.

Space for Construction of Complete Aeroplanes

In the case of shops which are to be used for the construction of complete aeroplanes a little more information is available. This space will

Table 2—Dimensions of Standard Hangar and Shop Buildings

Type	Inside Width	Length	Height	Door Size	Sides	Frame	Sheeting	Remarks
Type H Bessonneau	66' at cols. 76' bet. cols.	79'	13' at eaves 17' at center	13' high 66' wide	Sloping	Wood	Canvas	
U. S. Air Service Wood and Canvas	66' at cols. 75' bet. cols.	98'	16' at eaves 21' at center	16' high 66' wide	Vertical	Wood	Canvas	
U. S. Air Service 66' x 140' Steel	66'	140'	14' at eaves and center	14' high 66' wide	Vertical	All Steel	Galv. iron	Curtain type
U. S. Air Service 110' x 200' steel	110'	200'	28' at eaves and center	28' high 110' wide	Vertical	All Steel	Galv. iron	Curtain type
Milliken, 11 ft.	20', 40' or 60' 7' addit. bet. cols. in slop. sides	Units of 20' no limit	11' at eaves and center	11' high x multiples of 20' wide	Sloping or vertical	All steel	Usually galv. iron	Any type doors
Milliken, 14 ft.	20', 40' or 60'	Units of 20' no limit	14' at eaves and center	14' high multiples of 20' wide	Vertical	All steel	Usually galv. iron	Any type doors
Milliken, 17 ft.	20', 40' or 60'	Units of 20' no limit	17' at eaves and center	17' high multiples of 20' wide	Vertical	All steel	Usually galv. iron	Any type doors
Milliken, 21 ft.	20', 40' or 60' 7' addit. bet. cols. in slop. sides	Units of 20' no limit	21' at eaves and center	21' high multiples of 20' wide	Sloping or Vertical	All steel	Usually galv. iron	Any type doors
Austin Modified No. 3 Standard Bldg.	About 48'	Multiples of 20' no limit	13' at eaves and center	13' high about 48' wide	Vertical	Steel truss and cols.	Wood roof, steel sash, brick walls	Any type doors
Austin Semi-Standard	70', 80', 90' and 100'	Multiples of 20' no limit	Any	Width of Building any height	Vertical	Steel truss and cols.	Usually steel sash and brick walls	Any type doors
Strauss Type "A"	100'	100'	18'	18' high 100' wide	Vertical	All steel	Corrugated galv. iron	Strauss bascule operated by 5 h.p. motor
Truscon Steel Co. Type 1-S	32', 40', 48', 50' and 60' less cols.	Multiples of 2'	8'-0", 10'-8", 13'-4", 16'-0", 18'-8" and 21'-4"	Approx. same as bldg. height and width	Vertical	All steel	18 ga. flat copper steel	Small doors only (for curtain doors)
Belmont Iron Works	66'	Multiples of 20'	14', 18' and 28'	14', 18' & 28' high 66' wide	Vertical	All steel	Corr. steel or asb. prot. metal	Steel sliding doors
Belmont Iron Works	110'	Multiples of 20'	28'	28' high 110' wide	Vertical	All steel	Corr. steel or asb. prot. metal	Steel sliding doors
Belmont Iron Works	66'	Multiples of 20'	40'	40' high 66' wide	Vertical	All steel	Corr. steel or asb. prot. metal	Balloon hatch Steel sliding doors
Belmont Iron Works	45'	Multiples of 20'	46'	46' high 45' wide	Sloping	All steel	Corr. steel or asb. prot. metal	Balloon hatch Steel sliding doors
Belmont Iron Works	70'	Multiples of 20'	75'	75' high 70' wide	Sloping	All steel	Corr. steel or asb. prot. metal	Balloon hatch Steel sliding doors

Table 3—Landing field buildings. Approximate cost in the eastern part of the United States, June, 1922

fyng the division later if it becomes necessary :

Uses of Building	Type of Construction	Approx. Size	Cost per Sq. Ft. Erected		Per cent of total shop space
Factory, hangar, shop or garage.	Factory type. Steel frame, brick and glass sides. Wood roof. Erected complete on concrete foundations. Without floors. Clear span, 60' to 100'.	60' x 100' and up. 12-14' high.	\$1.25	\$1.50	Stockroom 8
			1.50	1.	Wood shop 16
Hangar, shop or garage.	All steel. Standardized, galv. sides and roof, with trim and ready painted. Erected on concrete piers. No floor. Clear span to 60'.	60' x 100' or less. 14' high.	Bldg., .60	\$.75	Metal shop 22
			Erect., .25	.30	Wing, etc., building 12
Shop, garage, stock room, radio, etc.	Light weight, all-steel, galv., unpainted. Erected on posts. No floor.	About 20' x 25'. 8' high.	\$.85	\$1.05	Assembly room 20
			Bldg., .90	\$1.05	Dope and paint shop. 8
Hangar, shop, garage, etc.	Large frame buildings. Wood truss, clear span to 50'. Wood siding and roof. Roof tar paper covered. Erected on posts. No floor.	Span up to 50'. Any length. 12' high.	Erect., .20	.30	Shipping and finished storage. . . 8
			\$.80	\$1.35	Offices 6
Office, stockroom, radio, etc.	Small wood frame buildings. Sectional type, bolt-together. Complete with all trim, partitions and ready painted. 7/8" flooring.	12'x18' to 18'x36' 8' headroom.	Mater., .40	\$.60	
			Erec. & paintg. .40	.60	
			\$.80	\$1.20	
			Bldg., .65	\$1.40	
			Erect., .15	.25	
			\$.80	\$1.65	

NOTE: These costs based upon construction of more than one building. Slightly higher for single buildings. Subject to increase in case of poor transportation or other such conditions. Heating, water, lighting, etc., not included. Hangar prices include only the less expensive types of doors. Based upon numerous estimates furnished for the purpose.

Table 4—Building flooring, heating and lighting. Approximate cost of installation in the eastern United States, June, 1922

FLOORING COSTS		Cost per Sq. Ft. in place	
CONCRETE.	4" floor, plus 1" finish; total, 5".....	\$0.18	\$0.25
CINDER.	9" steam cinders, spread and rolled manually to 6". Cost varies greatly according to local cost of material. Probable range.....	.05	.10
WOOD.	9" cinders, rolled to 6"; 3" x 4" creosoted sleepers; 1" Y. P. rough sub-flooring, creosoted on under side; 1" maple finished floor. Total cost.....	.33	.38
	Same floor on concrete base (4" rough concrete).....	.40	.45
WOOD BLOCK.	4" rough concrete base. Wood blocks on edge. Total cost.....	.40	.45
For preliminary estimate purposes assume flooring unit cost to vary inversely with the size of building as well as with local conditions.			
LIGHTING AND HEATING		Cost per Sq. Ft. of Floor Area for equp't. installed	
General shop lighting without drop lights or any special outlets, etc. Inside work only, no feeders. (Electrical).....		\$0.03	\$0.07
Shop heating plant completely installed. Steam system. To maintain ordinary shop working temperature.....		.25	.40
Lighting and heating cost subject to great variation and should be considered as crude approximations. For preliminary estimate purposes the use of the higher figures is advisable.			

ot only with the output but also with the plant efficiency, size of machine and its type. In general, seaplanes will require more floor space than land machines and flying boats will require more space than seaplanes for their construction and for the same output. During the war a number of large aeroplane factories turned out these machines in large quantities, using the following space: Total floor space per complete machine per day at quantity production ranging from 5,000 sq. ft. for small training machines to 60,000 sq. ft. for larger single engined machines. The area required is actually quite elastic and greatly affected by the conditions mentioned above. It is reasonably safe, however, to assume for preliminary purposes that 15,000 to 20,000 sq. ft. of floor will be required in the shop for an output of one complete moderate-sized (say 3,000 pounds fully loaded) aeroplane per week if the plant is to be run at full capacity. This space should be increased with the size of the machine and should be

liberally increased if more than one type of machine is to be built at the same time. Several more or less efficiently arranged American factories show about the following average division of their floor space for construction of different types of machines. It should be safe to use these figures in the original layout of the shop, modi-

Field Office and Stockroom
No matter how small the field equipment may be, some suitable heated and lighted space should be provided for office and stockroom. In the case of very small fields a 20 x 20 foot building is ample for both purposes. If some type of standardized steel or sectional wood building is used it can be extended from time to time as the field equipment expands. Many of the buildings of these types now on the market are suitable for the purpose. It will usually be found cheaper, as well as more convenient, to purchase such instead of having the local contractor erect special buildings which do not provide for the future expansion. Sectional wood buildings measuring about 18 x 24 feet, and reassembled in the field by bolting all together. Figure 6 shows the appearance of a completed building of this type. This size of building can be erected complete by two men in about 2 to 3 days. The heating can be most conveniently obtained by the use of a small round stove. On a field where little repair or construction is done this will be all of the heating absolutely necessary. The partitions purchased with the building can be used to divide it into field office, locker room and stockroom. Where running water is available, a toilet can also be installed. When our firm (A. & D. R. Black of New York and Washington) was in operation we designed a special



Fig. 4: Steel, Glass and Brick Type Building (Austin) Adapted to either Factory or Hangar use

sectional wood building for field office use which is shown in Figure 7. This building is so elastic that it became referred to in our office as the "rubber building." The arrangement is shown very completely in the illustration and little comment is necessary. The construction is started with one 20 x 20-foot unit. Additional 20 x 20-foot units are added as the need arises. The former outer wall of the first unit becomes a partition between it and the new unit as the addition is made. Once erected, no part of the building is ever moved even when extending it.

Gasoline and Oil Houses

At any field where several different owners are likely to have machines at one time, or where any quantity of such supplies is kept on hand, some provision for storage of gasoline and oil is necessary. One of the smallest steel or sectional wood buildings may be used for this purpose. It will be found, however, that even the smallest sizes of these provide much more space than is necessary. If such buildings are used, liberal vents should be cut in the walls to avoid danger of accumulation of gas. Racks should be constructed for the oil barrels and, if gasoline is purchased in this way, for the gasoline barrels also. Shelving for grease and other supplies should be installed. If the gasoline is to be stored in an underground tank, the most satisfactory, economical and safest method, the pump should be located inside of this building with the hose connection extending outside. This method renders the gasoline inaccessible when the storage house is locked and prevents pilfering. Figure 8 shows a gasoline, oil and grease house, specially designed for the purpose by us. The drawings for this house were completely detailed and ready for use by any local contractor or the field force. While quite small, 8 x 8 feet, this house has sufficient capacity for what would be

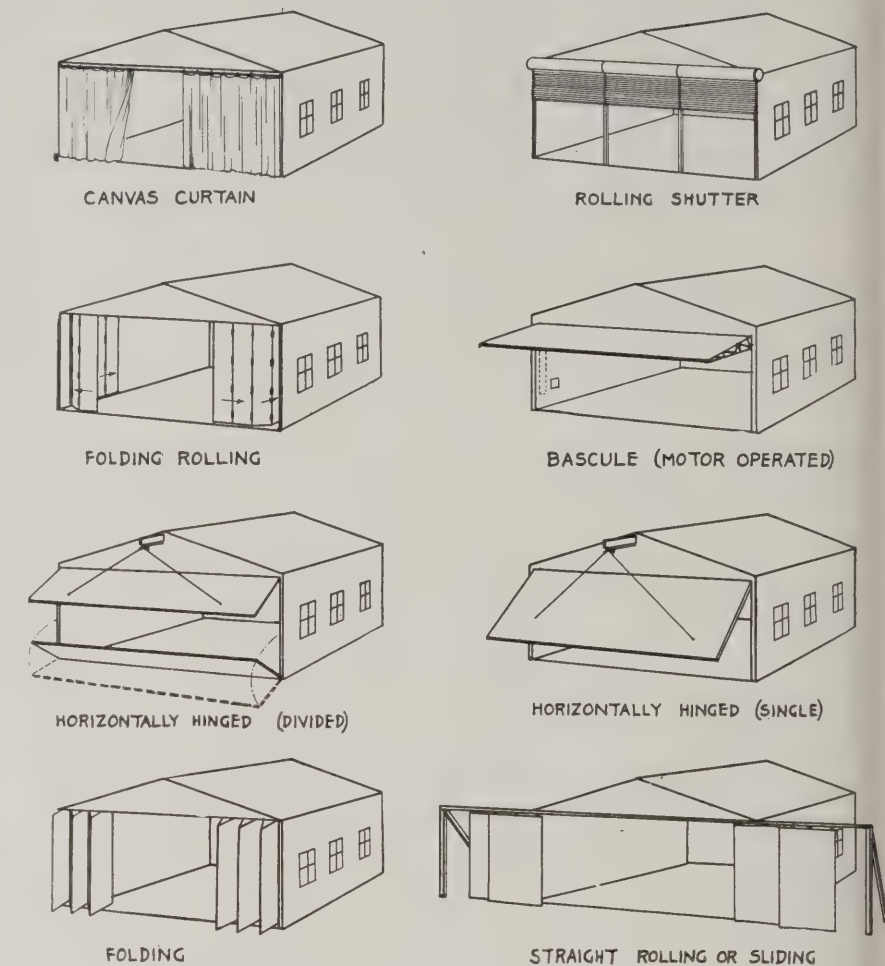


FIG. 5— TYPES OF HANGAR DOORS. } PRINTER— SET IN TYPE

LANDING FIELD BUILDINGS

today considered a large field equipment. It was assumed that reserve oil barrels would be kept outside unopened in the event of a large supply being kept on hand. Oil and gasoline houses can, very often, be built by the field force out of lumber from wing crates.

Miscellaneous Buildings

For special purposes such as barracks, remote controlled radio stations, dead storage, lunch rooms, etc., one or other of the standard steel or

sectional wood buildings on the market will usually be found suitable. For gate-houses, either one of the small sectional buildings may be used or the local contractor or field mer could build a one-man box for the shelter of the gateman. It is unlikely however, that there will be any gateman to worry about at most of the fields to be considered in the near future. In cases where toilet facilities are not installed in the field office building, shops or hangars, one or more latrines should be located on the property. Knocked-down buildings, designed for this purpose, can be purchased for about \$45, which is probably less than it would cost to have them built by a local contractor. It is also likely that wing crate lumber, available at the field, may be used considerably for the construction of these miscellaneous special buildings.

Planning for the Future

In the selection of buildings for landing fields, as well as in the general arrangement of these fields, every

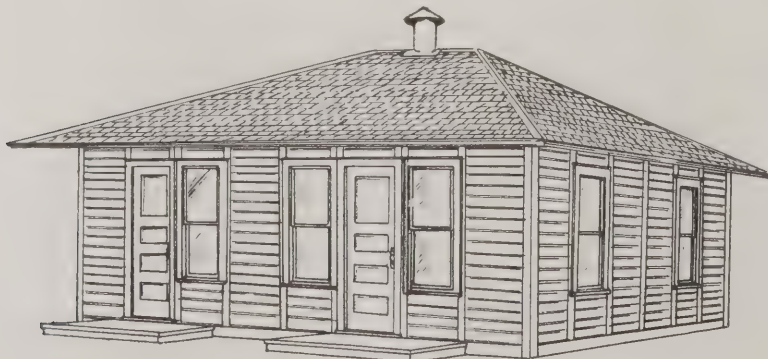


Fig. 6: Sectional Wood Buildings (Sears Roebuck & Co.)

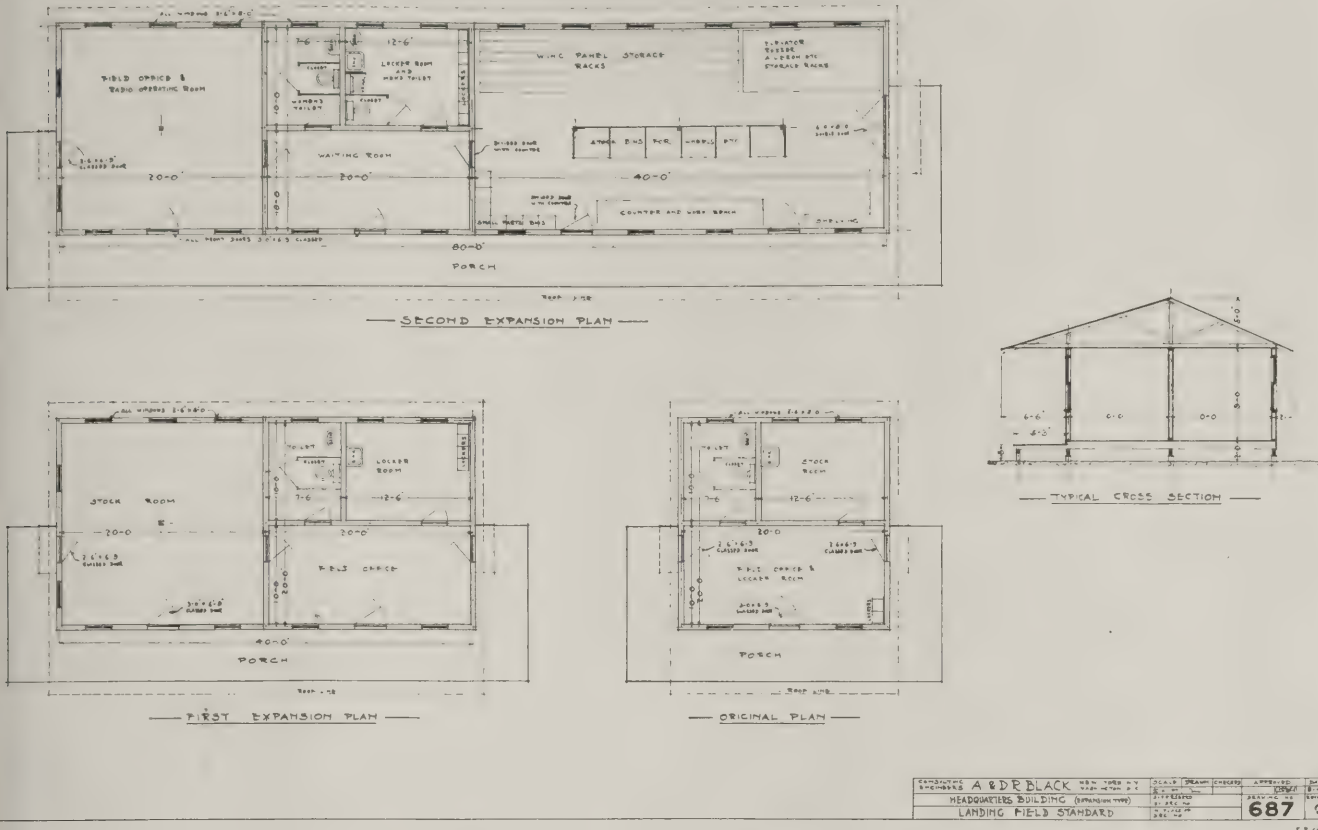


Fig. 7—Expansion Type of Field Building

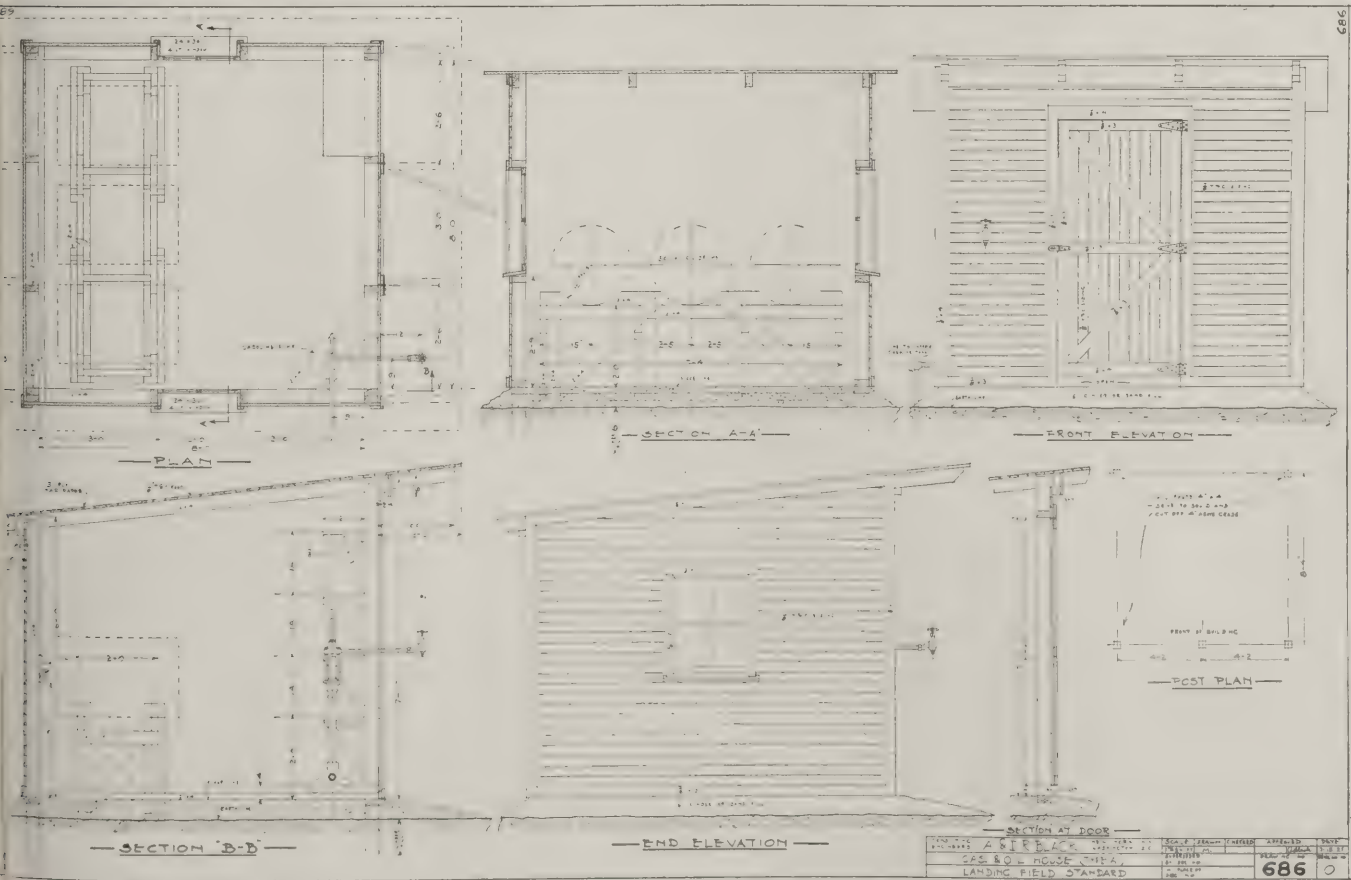


Fig. 8—Gasoline and Oil House

The Prediction of Propeller Characteristics from the Blade Element Analysis

By William H. Miller, M. Sc., Curtiss Aeroplane and Motor Corporation

Introduction

THE determination of the performance of the engine-propeller combination is closely connected with the problem of predicting the performance characteristics of a given propeller. If tests on the model of the propeller are available, one needs only to combine its characteristics with those of the engine. When no model test can be made, the propeller characteristics must be predicted analytically. The latter problem is principally one of finding the secondary angles of attack of the propeller when the blade angles and section aerodynamic characteristics have already been found.

A propeller is said to operate under *primary* conditions when the angles of attack of the blade sections correspond to those chosen for the design conditions. When the angles of attack are altered due to a different combination of forward speed and revolutions than that for which the blade angles were determined, the propeller is said to operate under *secondary* conditions.¹

¹Refer to "The Design of Screw Propellers for Aircraft," H. C. Watts.

If we ignore the effect of compressibility, the thrust and torque of an airscrew are functions of

Velocity of translation, V
Revolutions in unit time, n
Diameter, D
Absolute density of air, $\rho = \frac{\delta}{g}$

where δ is the specific weight of the air, ρ the absolute density, and g the gravitational acceleration.

By dimensional theory it is proved that

$$\text{(Thrust)} \quad T = \rho n^2 D^4 f \left(\frac{V}{nD} \right) \quad (1)$$

$$\text{(Torque)} \quad Q = \rho n^2 D^5 F \left(\frac{V}{nD} \right) \quad (2)$$

The efficiency, η , is obviously a function only of $\left(\frac{V}{nD} \right)$; that is

$$\eta = \phi \left(\frac{V}{nD} \right) \quad (3)$$

The functions f and F are usually termed respectively the thrust and torque coefficients. They are defined by

$$T_c = \frac{T}{\rho n^2 D^4} \quad (4)$$

$$Q_c = \frac{Q}{\rho n^2 D^5} \quad (5)$$

Dr. Leonard Bairstow has found that over the usual working range of an airscrew the following formulas hold very approximately true:

$$T_c = a - bJ^2 \quad (6)$$

$$Q_c = c - dJ^2 \quad (7)$$

where a , b , c and d are constants for a particular airscrew, and in which we use the abbreviation $J = \left(\frac{V}{nD} \right)$. The test for

the validity of (6) is to plot T_c against J^2 to see how closely the curve follows a linear law; and for (7) to plot Q_c against J^2 .

In Table I we give the characteristics and computed values for a two-blade propeller of typical form: Durand No. 116 (Report No. 64, National Advisory Committee for Aeronautics). The values of T_c and Q_c are expressed by Durand in the forms

$$T_c = \frac{T}{\delta V^2 D^2} \quad \text{and} \quad Q_c = \frac{Q}{\delta V^2 D^3}$$

and we have transformed these coefficients into the forms of (6) and (7) by multiplying by $9.8 J^2$, as the coefficients used in the above-mentioned report are expressed in terms of metric, gravitational units. The curves are given in Fig. 1.

We also give in Table II and Fig. 2 the data and curves for a model of the four-blade propeller for the B.E. 2c, the characteristics of which are taken from Report and Memoranda No. 344 of the Advisory Committee for Aeronautics (Great Britain.) In this case the curves show that Bairstow's equations are valid for an airscrew operating in the presence of the machine.

It is now evident that by estimating the thrust and torque of a propeller for primary conditions and, also, for some arbitrary value of J within the working range

²The working range for J seldom exceeds 0.4; we can at once determine the unknown constants a , b , c and d from the resulting four simultaneous equations. If the primary and secondary conditions, respectively, be designated by subscripts 1 and 2, we find:

$$\begin{aligned} a &= \frac{T_{c1}J_2^2 - T_{c2}J_1^2}{J_2^2 - J_1^2} \\ b &= \frac{T_{c1} - T_{c2}}{J_2^2 - J_1^2} \\ c &= \frac{Q_{c1}J_2^2 - Q_{c2}J_1^2}{J_2^2 - J_1^2} \\ d &= \frac{Q_{c1} - Q_{c2}}{J_2^2 - J_1^2} \end{aligned} \quad (8)$$

Then, knowing a , b , c , and d , we can plot the thrust and torque coefficients versus J^2 . The efficiency is found as follows:

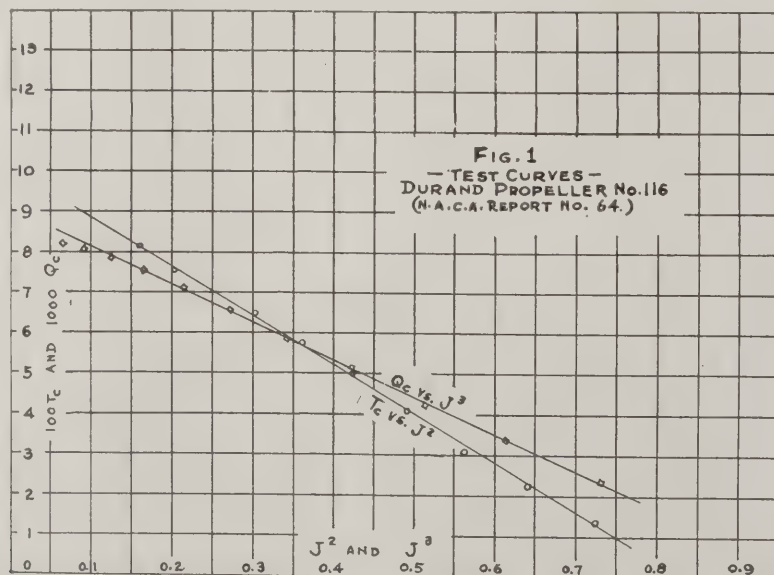
(Brake Power) $P_m = 2\pi nQ = 2\pi\rho Q_c n^2 D^5$
(Thrust Power) $P_u = TV = \rho T_c V n^2 D^4$
Hence

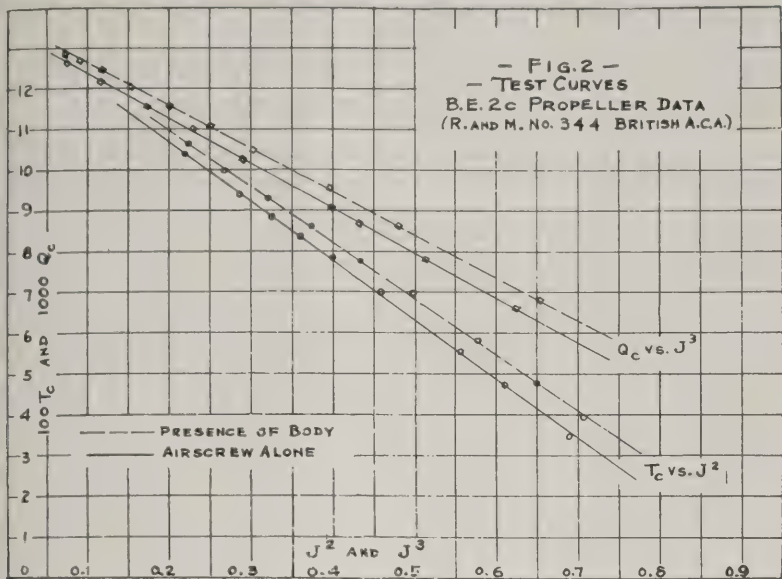
$$\text{(Efficiency)} \quad \eta = \frac{T_c}{2\pi Q_c} J \quad (9)$$

which is also plotted against J .

Résumé of Propeller Theory

In the case of the airscrew having forward motion, it is convenient to consider the velocity in the slip stream relative to that of the undisturbed air. Fundamentally the increase of velocity as one moves down stream is due to the difference of pressure fore and aft of the disc caused by the circulation around the blades. Once in motion, the air (possessing considerable inertia) tends to remain in motion; and this results a general superposed inflow which must be taken into account when determining the velocity of the air relative to the blades.





In examining the flow at a point in the stream, it is well to note that the total induced velocity at that point is due to the action of all the elements of the N blades of the propeller. For example, the flow at a point a given radial distance from the axis is not due simply to the action of a single blade element, at the same radius; but it is actually due to the action of all the elements on all blades. In the vortex theory one considers this velocity as being induced by the whole vortex system.

Let U be the general stream velocity of a mass of air passing through a small portion of an annulus of the disc. Apply the equation of d'Alembert for the accelerating force,

$$dF = dM \frac{d^2x}{dt^2}$$

Write $U \frac{dU}{dx}$ for $\frac{d^2x}{dt^2}$ and we have

$$dF = dM \cdot U \cdot \frac{dU}{dx}$$

Separating variables,

$$dF \cdot dx = U \cdot dM \cdot dU$$

We integrate between the limits of maximum and minimum velocity in the slipstream; thus:

$$\int \int dF \, dx = \frac{1}{2} \, dM \, (U_{\max}^2 - U_{\min}^2)$$

But $\int \int dF \, dx$ is the work done in unit time, and is equal to the product of the air reaction in the disc and velocity in the disc:

$$\int \int dF \, dx = dM \, U_d \, (U_{\max} - U_{\min})$$

when U_d is the velocity in the disc. Then we have the resulting relation

$$U_d \, (U_{\max} - U_{\min}) = \frac{1}{2} \, (U_{\max}^2 - U_{\min}^2)$$

Whereupon cancelling out the factor

$(U_{\max} - U_{\min})$ we obtain

$$\frac{U_d}{(U_{\max} + U_{\min})} = \frac{1}{2}$$

Now U_{\min} is equal to the velocity of the undisturbed air. Then if

$$U_d = U_{\min} + k' U_{\min}$$

and

$$U_{\max} = U_{\min} + k'' U_{\min}$$

we immediately find that

$$k'/k'' = \frac{1}{2}$$

Which means that half the added velocity is reached at the disc.³

³Refer to "The General Theory of Blade Screws," by George de Bothezat, N.A.C.A. Report No. 29, for a more complete proof of this last relation.

If we neglect the small radial component of the added velocity, we can consider the total acceleration of the fluid as being composed of two components perpendicular and parallel to the propeller disc. These we term the *axial* and *rotational* components of the *slip*. Let the proportion of axial slip to velocity of advance be designated by a and the ratio of rotational slip

to peripheral speed be designated by b ; then the resultant velocity of the air relative to the blade is given in magnitude and direction by

$$V_r = \sqrt{(2\pi r n)^2 (1 - b/2)^2 + V^2 (1 + a/2)^2} \quad (10)$$

$$\tan \phi' = \frac{V (1 + a/2)}{2\pi r n (1 - b/2)} = \frac{1 + a/2}{1 - b/2} \tan \phi \quad (11)$$

where, as shown in Fig. 3, the resultant velocity is denoted by V_r , and the effective pitch angle defined by

$$\phi = \arctan \frac{V}{2\pi r n} \quad (12)$$

r being the radius on the blade.

The differentials of thrust and torque are obtained by resolving the elemental total reaction at any radius into components perpendicular and parallel to the airscrew disc:

$$dT = dR \cos (\phi' + \gamma)$$

$$\frac{dQ}{r} = dR \sin (\phi' + \gamma)$$

where γ is the angle between the resultant reaction dR and the normal to V_r ; that is, if we separate the total reaction into components perpendicular and parallel to V_r ; then, as shown in Fig. 3,

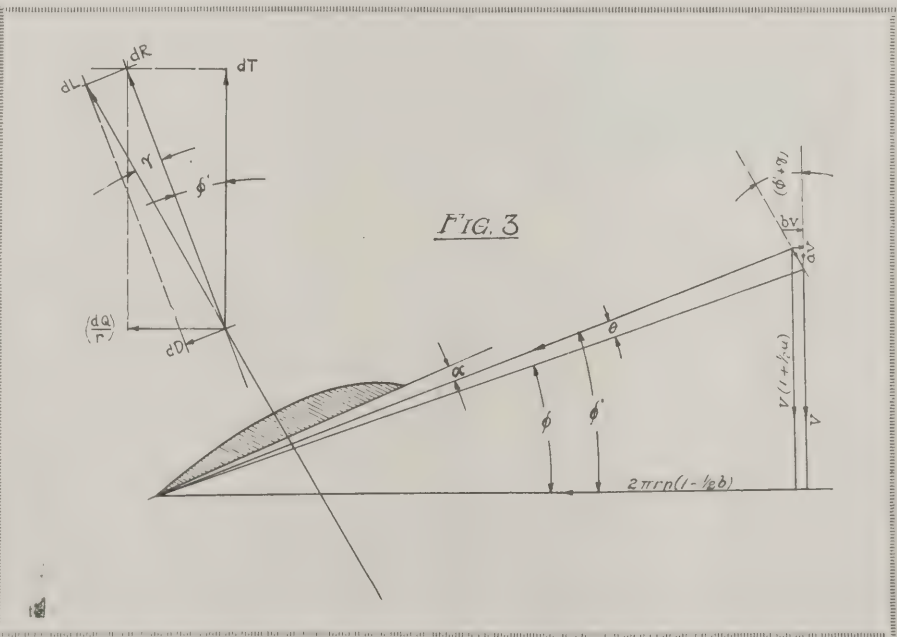
$$\frac{dR_D}{dR_L} = \tan \gamma$$

The flow around a propeller blade is quite similar to that around an aerofoil wing. The thrust is developed due to circulation. Vortices peel off the tips of the blades and dispose themselves over the slipstream boundary. We will therefore assume that the components dR_L and dR_D may be determined by expressions of the forms

$$dR_L = \rho C_L (c \, dr) V_r^2$$

$$dR_D = \rho C_D (c \, dr) V_r^2$$

where C_L and C_D are, respectively, the lift and drag coefficients of the particular blade element of chord c and area $(c \, dr)$. The differentials of thrust and torque may then



be written down in the following forms:

we have per element per blade,

$$dT = \rho C_L \sec \gamma c (1 + \frac{1}{2}a)^2 V^2 \csc^2 \phi' \cos(\phi' + \gamma) dr \quad (13a)$$

$$dT = \rho C_L c (1 + \frac{1}{2}a)^2 V^2 \csc^2 \phi' \cos \phi' (1 - \tan \phi' \tan \gamma) dr \quad (13b)$$

$$dQ = \rho C_L \sec \gamma c (1 + \frac{1}{2}a)^2 V^2 \csc^2 \phi' \sin(\phi' + \gamma) r dr \quad (14a)$$

$$dQ = \rho C_L c (1 + \frac{1}{2}a)^2 V^2 \csc^2 \phi' \sin \phi' (1 + \cot \phi' \tan \gamma) r dr \quad (14b)$$

It is, of course, necessary to evaluate either dT or dQ by only one of the above formulas, as we can make use of the obvious relation

$$\frac{dQ}{r} = dT \tan(\phi' + \gamma) \quad (15)$$

The thrust of the blade elements at a given radius may be equated to the thrust produced by the change of momentum of the air passing through the annulus of the disc. This momentum thrust per blade is equal to

$$dT = \frac{2\pi r}{N} (1 + \frac{1}{2}a) a V^2 dr \quad (16)$$

where N is the number of blades.

One must exercise care in writing down the relationship between the torque of the blade elements and the rate of change of angular momentum of the fluid, as the frictional forces are so large that they cannot be ignored. For our purposes we will not be required to seek the relation.

Let us assume that the fluid reaction in the disc is opposite and parallel to that of the blade element. It does not immediately follow that the total average slip,

$$\sqrt{(aV)^2 + (2\pi rnb)^2},$$

is opposite and parallel to dR ; but it can be shown that, for high speeds of forward motion, when the contraction of the slipstream is small, we can write with sufficient approximation,

$$\tan(\phi' + \gamma) = \frac{2\pi rnb}{aV} = \frac{b \cot \phi}{a} \quad (17)$$

We now proceed to evaluate ϕ' , which is also defined by

$$\phi' = \phi + \theta \quad (18)$$

θ being the "slip angle." First equate (13b) and (16). We will obtain the equation

$$\frac{Nc}{2\pi r} C_L = \frac{a \tan \phi' \sin \phi'}{(1 + \frac{1}{2}a)(1 + \tan \phi' \tan \gamma)} \quad (19)$$

Let the ratio of total blade width to circumference, at any radius, be designated by m ; that is

$$\frac{Nc}{2\pi r} = m \quad (20)$$

Then we obtain

$$\frac{a}{(1 + \frac{1}{2}a)} = \frac{m C_L (1 + \tan \phi' \tan \gamma)}{\tan \phi' \sin \phi'} \quad (21)$$

The quantity a can be evaluated by means of (11), (12), and (17); from which we find that

$$a = \frac{2 \cot \phi' (\tan \phi' - \tan \phi)}{1 + \tan \phi' \tan (\phi' + \gamma)} \quad (22)$$

$$(26) \quad \alpha = \beta_0 - \phi - \theta$$

Report No.	J ²	J ³	T ^c	Q ^c	T ^c	Q ^c
.40	.1600	.064	.0518	.00522	.0815	.00820
.45	.2025	.091	.0380	.00405	.0756	.00804
.50	.2500	.125	.0285	.00321	.0700	.00787
.55	.3025	.166	.0219	.00255	.0650	.00756
.60	.3600	.216	.0164	.00202	.0579	.00713
.65	.4225	.274	.0120	.00157	.0498	.00650
.70	.4900	.343	.0084	.00124	.0404	.00595
.75	.5625	.422	.0056	.00094	.0310	.00518
.80	.6400	.512	.0036	.00068	.0227	.00426
.85	.7225	.614	.0019	.00047	.0135	.00336
.90	.8100	.729	.0008	.00030	.0065	.00238

NOTE: $T^c = 9.8 T^{c'} (nD -)^2 = 9.8 T^{c'} J^2$

TABLE II
PROPELLER FOR THE B. E. 2c.
Reports and memoranda No. 344, Advisory Committee for Aeronautics.
Data for Aircrew Alone.

J	T ^c	J ²	J	Q ^c	J ³
.469	.1041	.220	.423	.01262	.075
.535	.0941	.286	.489	.01219	.117
.570	.0885	.325	.558	.01157	.173
.600	.0836	.360	.611	.01100	.228
.632	.0784	.399	.662	.01027	.290
.677	.0702	.458	.735	.00909	.397
.685	.0687	.469	.756	.00870	.432
.747	.0555	.558	.800	.00781	.512
.770	.0500	.594	.854	.00661	.623
.781	.0475	.610			
.829	.0349	.687			

J	T ^c	J ²	J	Q ^c	J ³
.475	.1064	.225	.416	.01280	.072
.518	.0998	.268	.442	.01268	.086
.565	.0930	.319	.494	.01236	.120
.611	.0861	.373	.534	.01203	.152
.661	.0778	.436	.585	.01158	.200
.705	.0699	.497	.630	.01107	.250
.760	.0586	.577	.672	.01051	.303
.805	.0479	.648	.734	.00954	.395
.840	.0395	.705	.783	.00862	.480
			.880	.00652	.681

We then obtain

$$a = \frac{2 \cot \phi' (\tan \phi' - \tan \phi)}{1 + \tan \phi' \tan (\phi' + \gamma)} \quad (23)$$

Since, in determining the thrust and torque we make use of the quantity $V (1 + \frac{1}{2}a)$, we note from (12) that

$$V (1 + \frac{1}{2}a) = 2\pi r n \tan \phi' \frac{[1 + \tan \phi' \tan (\phi' + \gamma)]}{[1 + \tan \phi' \tan (\phi' + \gamma)]} \quad (24)$$

which formula gives the axial velocity of the air relative to the blade element.

After equating (21) and (23) we finally obtain the equation

$$\frac{m C_L}{2} = \frac{1 - \tan \gamma \tan (\phi - \phi')}{\sin \phi' \tan (\phi' - \phi)}$$

Since θ and γ are both small angles (neither exceeding 6° or 8° over the working range, and usually having values less than 5°) we can safely neglect the term $\tan \theta \tan \gamma$ and write approximately,

$$\frac{m C_L}{2} = \sin (\phi + \theta) \tan \theta \quad (25)$$

Aerodynamical laboratory experiments have shown that over a range of angles of attack, α , measured from zero lift of the aerofoil, to within about 4° of maximum lift, we can write very approximately

$$C_L = k \sigma$$

where k is the constant slope of the lift curve when plotted against angle of attack. If the total blade angle referred to the zero lift line of the section be designated by β_0 , then the angle of attack of the section, measured with reference to the zero lift line is

$$\alpha = \beta_0 - \phi - \theta$$

We can therefore write (25) as

$$(\beta_0 - \phi - \theta) = \sin (\phi + \theta) \tan \theta$$

Under the primary conditions for which the aircrew is designed, the angles of attack are usually arbitrarily fixed, and the slip angles and blade angles are unknown. The blade angles (except for the adjustable pitch propeller) remain fixed throughout the working range and hence the slip angles and angles of attack are to be determined for secondary conditions.

To solve (25), we recall that θ is a small angle and use the approximations

$$\sin \theta = \tan \theta = \theta$$

$$\cos \theta = 1$$

Then an ordinary quadratic in θ is obtained,

$$\theta^2 + \theta \tan \phi - \frac{m C_L}{2 \cos \phi} = 0$$

Expressing θ in degrees, we find

$$\theta = 28.65 \tan \phi \sqrt{1 + \frac{2 m C_L}{\cos \phi \tan^2 \phi} - 1} \quad (27)$$

Which formula is used for evaluating the slip angle for primary conditions, since C_L , m , and ϕ are all known.

In order to determine the secondary values of θ we proceed exactly as before, using (26). We find that, if k is taken in absolute units per degree, the quadratic obtained is

$$\theta + 57.3 \mu \theta - 57.3 \left[\frac{m k (\beta_0 - \phi)}{2 \cos \phi} \right] = 0$$

where we use the notation

$$\mu = \tan \phi + 28.65 \frac{m k}{\cos \phi} \quad (28)$$

The solution is

$$\theta = 28.65 \mu \left[\sqrt{1 + \frac{2 m k (\beta_0 - \phi)}{\mu^2 \cos \phi} - 1} \right] \quad (29)$$

(To be continued)

The Curtiss Sail Plane

Introducing a New Sport to America

FOR two periods of thirty seconds each, on Sept. 6, Glenn H. Curtiss remained aloft in his new sailplane of silk, wood and duralumin which he believes will eventually rise without motive power from the surface of the sea.

The tests were preliminary and purely experimental. There was no intention nor effort to establish a record and the results consequently appear all the more significant. Mr. Curtiss expressed himself as highly gratified with the manner in which the craft handled and declared that continued trials, day by day, would be made.

The demonstration was off Plum Beach, Port Washington, Long Island. There were present but a few people, officials of the Curtiss Aeroplane and Motor Corporation, the Aeronautical Chamber of Commerce and the Aero Club of America, and representatives of the press. There was practically no wind, shortly after 10 o'clock in the morning, when the sailplane was towed to the scene from the hangars of Lieut.-Comm. David McCulloch, in Port Washington Harbor.

The event was of extraordinary interest. Coupled with the international attention which is being given to gliding and sailing, was the fact that this marked the return of Mr. Curtiss to practical, actual flight. For five years of so Mr. Curtiss had not piloted a plane. His conviction that the flying boat could be adapted to sailing, thereby lessening the horse-power and decreasing the cost of operation, led to continued experiments in the Curtiss research laboratory at Garden City, under his personal supervision. The seaplane, being his own de-

velopment, it was natural that he should reserve to himself the privilege to fly it first.

With Mr. Curtiss on Plum Beach was W. L. Gilmore, chief engineer of the Curtiss Aeroplane and Motor Corporation. Mr. Gilmore in a bathing suit, acted as assistant in the rather delicate undertaking of getting the sailplane towed properly and into the air. The towing was done by a speed boat, equipped with one of the Curtiss O X engines. Due to the excessive calm, difficulty was experienced with the towing cord, which snapped several times. But on the third towing trial, at a height of 20 or 30 feet, Mr. Curtiss cast loose, and, in spite of the dead air, sailed for half a minute. The ease of control was evident. The craft was equipped with the shoulder system of control, which Mr. Curtiss utilized in the early days of flying.

After a number of trials it became apparent that further effort at that point would be futile and preparations were made for the

return. It was on this trip that the surprising developments came. It is about two miles from Plum Point to the McCulloch hangar. It took the speed boat about five minutes to make the trip. A cross breeze of slight velocity arose and for half the distance, Mr. Gilmore, sitting in the speed boat, literally "held" Mr. Curtiss and the sailplane in his hand. The plane "floated" along with only an occasional pull from Mr. Gilmore. At the end of the trip, Mr. Curtiss cut loose and "sailed" to the entrance of the hangar.

The Curtiss sailplane is a miniature N. C. boat, the huge craft which were the first to fly the Atlantic. Its dimensions are—Weight (empty) 150 pounds; loaded (one man), 310 pounds; span, 28 feet; chord, 60 inches; gap, 54 inches; length over all, 22 feet 11 inches; wing area, 267.5 sq. ft; hull, 13 feet 2-1/4 inches long, 30-inch beam. The hull is made of duralumin. The glider is designed to fly at twenty miles an hour.



The Curtiss Sailplane

The Latest Commercial Machine for Economic Transportation

THE airplane illustrated below was designed and constructed at Omaha, Nebraska, by Mr. G. M. Bellanca, assisted by a number of business and professional men interested in the development of aviation.

The machine has been under al-

most continual test performance since the beginning of June, including attendance and participation in Airplane Meets in three States, including the Monmouth Meet in Illinois and the Tarkio and Norfolk Meets in Missouri and Nebraska.

The remarkable performance of

this machine has created much interest in aeronautical circles and places the ship in a class among the best designed monoplanes of the day.

The general specifications of the Bellanca C F-5 are as follows:

Type—Cabin monoplane carrying four passengers and pilot.

Span upper plane.....40 ft.
 Span lower plane.....22 ft.
 Chord lower plane.....6 ft. 6 in.
 Total wing area.....290 sq. ft.
 Length overall.....23 ft. 10 in.
 Height over all.....7 ft. 7 in.
 Weight empty.....950 lbs.
 Useful load.....1040 lbs.
 Weight loaded.....1990 lbs.
 Weight per sq. ft.....6.85 lbs.
 Pay load, exclusive of gas and oil
 for 600 miles, and pilot.....680 lbs.

Performance.

Light load 1200-lbs.

Max. Speed.....109.8 M. P. H.
 Min. speed.....40-M. P. H.
 Speed Range.....3.7 to 1
 Climbing rate per min.....1100
 Climb in 10-minutes.....7000-ft.
 Min. effective hp. required for
 horizontal flight.....14-H. P.

Full Load

Max. speed.....108-M. P. H.
 Min. speed.....40-M. P. H.
 Climbing rate per minute.....600-ft
 Climbing in 10-minutes.....5000-ft.
 Min. effective H. P. required
 for horizontal flight.....31-H. P.

Gliding angle.....12 to 1
 Capacity of tanks (oil and gas) 38-
 gal.

Fuel consumption at full speed
 (oil and gas)9.5-gal. per hr.
 Range, full speed.....440-miles
 Range, cruising speed.....600-miles
 Miles to gallon of fuel (oil and
 gas).....16-miles

Some of the note-worthy features
 embodied by this plane are—its sim-
 plicity of design, absence of wires,
 lightness, economy, quick take-off,
 low landing speed, high speed at-
 tained with a large pay load—low cost
 of manufacture, maintenance and
 operation.

Motor

The motor used is an Anzanni 90-
 H. P. with ten air-cooled cylinders,

weighing 385-lbs. Two magnetos, a Zenith carburetor and double air pump was used. Although the cylinders project a minimum distance from the hood, thereby reducing the parasite resistance, no overheating has been experienced after three-hour periods of continuous flying.

The propeller, especially designed by Mr. Bellanca, is 8-ft. diameter and 8-ft. pitch, mounting at the center an aluminum spinner with louvers, for cooling central parts of the engine.

Wings

The spars are I-section of Port Orford cedar, and project from the inner end of the wings 20 inches, thus forming an attachment of wings to the fuselage. The construction at the center is such that the compression stress is continuous without being transferred through the fuselage.

The wing ribs are a combination of ash, bass wood and cloth, weighing nine-ounces each, and have sustained a sand loading of 700-lbs. each.

The lower wings are much smaller than the main wings, and are attached at intermediate points to the upper wings which cantilever beyond these points.

Fuselage

The fuselage is of box girder construction, having a good steam line form internally reinforced with cables and wires. The cabin accommodates four passengers, although two additional passengers may be carried.

The engine compartment is separated from the passengers in order to be more conducive to comfort.

Three windows are provided on each side of the cabin, and one in front.

Tail Group and Controls

The empennage consist of a fixed stabilizer, to this are fastened the elevator flaps.

The oval shaped rudder with suffi-

cient area insures complete control under all circumstances in landing. Rudder is operated by a foot bar, while the lateral and longitudinal balance is operated by stick control.

Landing Gear

The chassis consist of two ash stream line struts glued together with birch veneer, forming the V shaped type—the whole in combination with the shock absorbers form a light simple construction.

Various Factors and Strength of Parts

The fuselage is designed to take a load of 35-lbs. per sq. ft. at the tail surfaces, stabilizers and elevators with a factor of 2 and proved by various test.

Stabilizers and elevators are made to stand a load of 50-lbs. per sq. ft. and the rudder a load of 35-lbs. per sq. ft.

The landing gear has a factor of 8.

The factor at the cantilever on wings in rear spar is 9—the weakest point, while the front spar at this point is 10.5.

The factor for reverse air load is 5.5. The factor for load lifting on 1/4-in. cables is 14.

L. D. on upper wing is 20; L. D. on lower wing is 16.4.

L. D. combined wings (upper and lower wings) and resistance of wires and struts is 18. The advantage of this combination compared with internal braced wings may be readily seen.

Actual Performance

This machine won first prize in four contests at Monmouth, Illinois. It covered in the speed contest the 15-mile triangular circuit in 9-min. 15-sec. The second best machine with 150-H. P. motor covered this course in 11-min. 30-sec. This course was covered in another contest by an S. V. A. (220-H. P. SPA) in 8-min. 33-sec.

The trip from Fort Crook to Mon-



The Bellanca C-F 5

nouth via Des Moines, 301-miles, was made in 3-hrs. 11-min. against a head wind, averaging 95-miles per hour, with a consumption of 21.5-gal. of gasoline.

This machine made a cruising speed on this trip of 95-miles per hour, with 4-miles per gallon of gasoline. Without the head wind this machine makes 16-miles to a gallon of gasoline.

The Bellanca CF in the gliding contest required 4-min. 43-sec. to descend

from an altitude of 2,000-ft. covering a distance of 4-1/2-miles with a gliding ratio of 12 to 1. The nearest competitor required 3-min. 44-sec.

The climbing contest showed that the Bellanca CF climbed 7,000 ft. in 11-min with a 150-h. p. motor attained only 6,000-ft. in 14-min. While the third machine attained only 5600-ft. in 12 1/2-min.

The Bellanca CF can be assembled ready to fly in 30-minutes

due to its simplicity of construction.

The machine participated in two other Meets, one at Tarkio, Mo., and the other at Norfolk, Neb. At Tarkio the machine won 1st prize in three events entered, which were silver cups and at Norfolk it won 1st prize in all the flying events of the Meet; namely one silver cup and \$400 cash. In many events at Norfolk the machine showed better performance than it did in the Monmouth Meet.

Aeronautic Progress in Canada

By E. G. Wilson

THE question of civil aviation is receiving no little attention in the best be illustrated by a reference to the work being done by the Canadian Air Board in preparing mosaic maps of industrial regions and large engineering projects. The main purpose of the air service in Canada is to develop and train aviators to meet the needs of national defence in the future, and for that purpose a great deal of experimental work and training of men in air operations has to be carried out. It has been found feasible to promote this training simultaneously with performing valuable services to the civil branches of the government and to the cities and towns. In the reports of the Air Board it is shown that it carries out experimental aerial surveys and considerable research work in connection with the development of aerial photography.

The board rendered considerable service to those who are making a study of the project to deepen the St. Lawrence river, and to create a vast supply of hydro electric energy for use of the United States and Canada. It has made mosaic maps of important industrial areas and large canals. It has provided maps of cities and towns for the purpose of facilitating the work of preparing comprehensive plans of urban developments. These mosaic maps cover the whole of the metropolitan areas surrounding cities. The oblique photographs which can be obtained in England are interesting, but are not nearly so valuable for practical purposes as the mosaic maps taken vertically from the air. These maps are not accurate enough to take the place of the ground survey, but are of great value in giving details and in presenting a bird's eye view of physical conditions. Recently, when the project of changing the Air Board into the defence ministry was before the Govern-

ment, Mr. Thomas Adams, town planning adviser to the Canadian government, submitted a statement to Premier W. L. Mackenzie King, drawing attention to the valuable work which the Air Board had done, and was doing. In this statement attention was drawn to an aerial survey that was being made of a proposed national park. It was indicated that the survey would save a considerable sum of money, and give an impression of the country that would be unobtainable by any other means. The premier replied that he was sure the ministry of defence would be the first to see that any changes would not operate against the fullest utilization of the air services for civil purposes.

The widespread aerial activities in Canada show that flying is no longer an exceptional feat, but is becoming gradually an ordinary phase of transportation. The steady progress made by the firms employing aircraft as a subsidiary to their main operations is perhaps the most gratifying of the operations during the past year. In the province of Quebec several of the large pulp and paper companies are now employing aircraft regularly in connection with their forestry work, for survey, fire protection and transportation within their limits. The success attending such developments gives promise of a steady outlet for commercial flying.

In its annual report, just recently issued, the Air Board has the following to say concerning the present status of civil and commercial flying operations in the Dominion: "Considering the progress as a whole there is no need for discouragement. Aviation is passing through a normal phase of its development. The boom period following the war is dying down. Consolidation is taking place and experience is showing those operations which will prove

not only profitable, but of value to the community as a whole. This phase will continue for a further period of years, during which the more temporary phases of flying will disappear and useful forms of work will be gradually developed. The opportunities for commercial flying in Canada, are unequalled in any part of the world. Development takes time and financial conditions are adverse, but those interested in aviation may look forward with confidence to steady progress along sound lines. The work done by the pioneers will reap its reward and with the production of more efficient types of machines and engines, there is no doubt but that aviation will play an increased part in the development and conservation of the resources of this Dominion.

"Mail and passenger services will follow more slowly as the present forms of transportation are efficient, highly developed and serve their purpose well. As an auxiliary to these services aircraft already play some part and a great opening exists here, especially in regard to summer tourist traffic. As the public gains confidence in flying, the demand for faster mails will become insistent and air mail passenger and express services will follow.

"The greatest need in aviation today is the creation of public confidence. This is essential to progress and, so long as it is lacking aviation cannot succeed. This cannot be gained by freak operations or stunts, however brilliant, but only by strict adherence to business principles and conservative operations on the part of aviation executives and careful flying on the part of pilots."

THE NEWS of THE MONTH

Convention Fifth District N. A. A.

The first convention of the Fifth District (Ohio, Indiana, Kentucky and Virginia) of the National Aeronautic Association of the United States was held at Cedar Point, Ohio, August 25 and 26.

Maj. Alfred W. Harris, Cleveland Chairman, welcomed the Detroit and Cleveland delegations who arrived from the air, also extended a welcome to all delegates. Seventeen cities were represented.

Hugh W. Robertson, Executive Committee, Detroit Aviation Society, gave details of arrangements for National Aero Congress and Pulitzer Races at Detroit, October 12-13-14. The Chairman replied pledging support of large delegation from Fifth District.

Lt. Col. H. E. Hartney, Executive Sec'y. National Aeronautic Association, Washington, D. C. spoke, praising liberal assistance shown by Mr. Howard E. Coffin, in particular, and others in general, in assisting his work.

Outlined official standing of Air Boards.

Gave instructions to delegates how to form their own air Boards on returning to their cities.

"Aeronautics cannot be a one man proposition—Air Boards solve all local questions for aviation".

Mentioned Squadron Re-Unions for national convention and also Field Reunions. Army and Navy and Lighter than Air reunions.

Arthur Halstead, Sec'y. Sectional Committee, Bureau of

Standards, Washington, D. C., outlined the work which the Bureau and the Society of Automotive Engineers are doing in compiling the American Aeronautical Safety Code. This will form the nucleus for the Board of Aeronautics, when formed, to work with. A resolution later was passed, endorsing the work of this Department and the Secretary instructed to forward copies of same to the Bureau of Standards, and Society of Automotive Engineers.

Howard E. Coffin, of Detroit, Mich. spoke at length on the intensive study covering a number of years which he personally had given the subject of aviation. He emphasized the necessity of having a National Association from similar experiences in the automobile and Good Roads developments. Omitting the technical side of the question which he said would take care of itself, the two main factors in holding up the development of aeronautics to-day are: (a) Fear of riding in planes (coming from ignorance) (b) Lack of Legislation (federal, state and municipal).

He deplored the inactivity of Congress in passing laws already drafted, and predicted government subsidy or aid for the commercial airplane industry. He painted a word picture of future Pulitzer races, predicting eliminating trial meets in all sections of the country preliminary to the great flying classic, at which time the various district organizations could con-

vene and elect their delegates to the National Aero Congress.

William B. Stout, Designer and Manufacturer, Detroit, also addressed the meeting reciting some of the problems confronting the aeronautical interests today. He pledged active co-operation to the national body. He also stated that the Technical development was keeping place with the times.

Harvey Campbell, Secretary Board of Commerce, Detroit Mich. gave a brief outline of what the "Dynamic City" was preparing to do for the National Aero Congress and assured delegates that they would be well taken care of in Detroit. He stated that Detroiters were convinced that Aircraft is the next important industry and urged everyone to get in behind the movement for the N. A. A.

He deplored the adverse publicity methods of the press and suggested the addition to all crash stories (in black face type) "This is another example of the vital need of adequate Federal Legislation."

It was unanimously decided to postpone election of permanent officers, and ask the temporary officers to continue to carry on until the next meeting in Detroit, October 11th., the day preceding the National Convention.

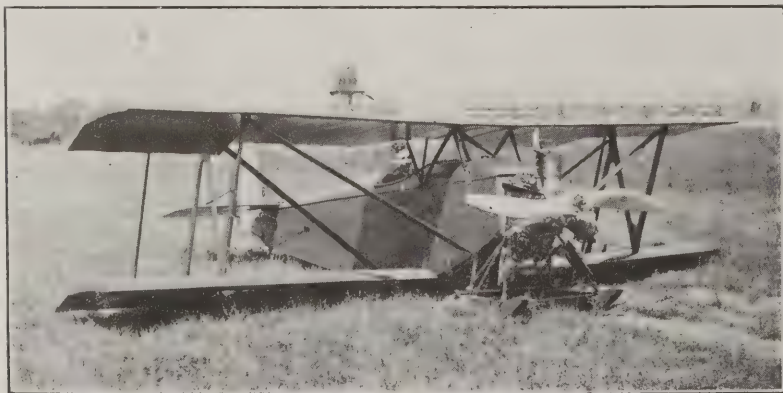
During the session flying boats "Buckeye" and "Wolverine" of the Aeromarine Airways Company, flying boats of Messers. Long, of Lorain, and Audregg Bros. of Mansfield, Ohio, the "Great Lakes" cabin cruiser, of the Great Lakes Airways Company, Cleveland, Ohio, and "Waco" three passenger airplane of Weaver Air-Cedar Point during the convention of Medina, Ohio, flew in to tion.

International Aero Show

To Open in Paris Dec. 15

Arrangements have just been completed for an Eighth International Aeronautical Exposition to be held in Paris between Dec. 15, 1922 and Jan 2, 1923, in the Grand Palais des Champs-Elysees.

The classification of exhibits



A Messenger Biplane Equipped with the New Sperry Landing Skids—
Lawrence B. Sperry at the Wheel

hydroplanes, helicopters, gliders, provides for balloons, airplanes, motors, aerial navigation, metallurgy and construction materials with reference to aeronautical use, methods of manufacture, transportation and maintenance of aeronautical machines and apparatus, meteorology, aerial physiology, photography, cinematography, map making and bibliography.

Prospective exhibitors may obtain detailed information from the Commissioner General of the exposition, Andre Granet, No. 9 Rue de la Forge, Paris.

Co-operative Engine Test

The Post Office Department, the Navy and the Army have joined hands to make some endurance tests with airplane motors using high compression. The problem of compression in airplane engines, being intimately connected with cost of operation, power and altitude is one of great importance in airplane circles.

The Post Office Department has receiver word that the first of the high compression pistons lent by the Army and Navy Departments, have been installed in planes flying on the Cheyenne to Salt Lake City leg of the trans-continental air mail route. There where the altitude is 6,000 feet and planes often have to fly more than 9,000 to top the mountains, the rarified atmosphere lends itself to the use of high compression motors.

The equipment loaned by the Navy will have 6 to 1 ratio while the Army pistons are designed for 6.5 to 1 compression.

Ordinarily airplane engines use a five to one ratio of compression. At sea level with an atmospheric pressure of 14.7 these engines will function at rated horsepower. However, in the higher altitudes where the air pressure is lighter the compression is necessarily less and the efficiency is cut considerably. Engines fitted with high compression for high altitudes knock at low altitudes. The Army and the Navy have long been experimenting to overcome the difficulty in order to increase the power of their machine in high flying. One of the developments has been an anti-knock fuel. The Army and the Navy, however, have no opportunity for sustained tests as in the case with the Air Mail Service. Moreover the high elevation of parts of the western route are better suited to high compression engines. For this reason, the tests will be made to determine if an increase in speed

and carrying power can be secured and if the engines will function well under such compression.

Aero Club of Pennsylvania

The stated monthly meetings of the Club for the coming season will commence with the September meeting which will be held at the Engineers' Club, 1317 Spruce Street, Friday Evening, September 15th, at 8 o'clock sharp.

To all of our members it will come as sad news that our beloved Secretary, Dr. George S. Gassner, died August 25th. As one of, if not the oldest member of our Club, he has been the most active and hardest worker of our organization; a founder member and the one remaining tie to the early history of the Club. It is the expression of our entire membership that his loss will be keenly felt by our Aero Club and his host of friends who held him in such high esteem.

It is hoped that every member of the Club will make a special effort to attend this opening meeting and discuss freely plans and ideas for the coming season. It is planned that in the future, monthly meetings will be regularly held and that renewed interest and increased membership will result therefrom. The program Committee is planning to map out a most interesting course of lectures on aeronautics by proship gradually but those who have minent engineers, builders and well known pilots. If sufficient interest can be aroused, a model contest will be held early in Octo-

ber. It is also planned to arrange to hold a Field Day Meeting at an early date at the Pine Valley Flying Field—prizes of free aerial rides will be offered new members and a special rate will be extended to all Club members who desire to take a flight.

New interest in aeronautics is being shown throughout the country and increasing activity indicates a slow but steady growth of the business. The reports of the great commercial air lines conducted in this and foreign countries and of the U. S. Air Mail Service, of millions of miles flown during the past year without accident, shows conclusively that air travel on these lines is practically safe, if not even safer, than any other mode of travel; with almost equal comfort and in half to a quarter of the time.

Let us turn out in full force and have a well attended meeting, discuss our plans for the future, talk over with the Program Committee plans to interest and bring out the members. It is not too early to discuss who we want for officers for the coming year and many of the older officers feel that they should be retired to the Board of Directors and that the new members be put in charge. Our Club is in a good healthy financial condition and increasing in member-held office for many years believe that those who have lately joined our ranks are entitled to the honor of holding office and building up the Club.

JOSEPH A. STEINMETZ
President



The Ballancer CF-5 described on page 503

THE AIRCRAFT TRADE REVIEW

Aeronautical Chamber of Commerce Elects Officers

AT the annual meeting of the nautical Chamber of Commerce of America, 501 Fifth Avenue, the following officers were elected: President, Inglis M. Upperco, Aeromarine Plane & Motor Co., Keyport N. J.; First Vice-President, Charles L. Lawrence, Lawrence Aero-Engine Corp., New York City; Second Vice-President, C. C. Witmer, Airship Manufacturing Company of America, Hammondsport, New York; Third Vice-President, Lawrence B. Sperry, Lawrence Sperry Aircraft Co., Farmingdale, L. I.; Treasurer, Charles H. Colvin, Pioneer Instrument Company, Brooklyn N. Y.; General Manager and Assistant Treasurer, S. S. Bradley; Secretary, Luther K. Bell; Assistant Secretary, Owen A. Shannon.

Increases in the Board of Governors from eleven to fifteen were made as follows: I. M. Upperco; G. M. Williams, General Manager, Dayton Wright Company, Dayton, Ohio; W. C. Young, Goodyear Tire & Rubber Company, Akron, Ohio; Charles L. Lawrence.

Steady growth by the Aeronautical Chamber of Commerce was reported; recent additions to the

membership including Goodrich Rubber Co., Akron, Ohio; Goodyear Tire & Rubber Co., Akron, Ohio; Wolverine Lubricants Co. of New York, New York; Rich Tool Co., Chicago, Ill.; Mosler Metal Products Corp., Mt. Vernon N. Y.

Baldwin Aircraft Corporation

The Baldwin Aircraft Corporation recently obtained possession of the well equipped plant and other manufacturing facilities of the Ordnance Engineering Corporation and is now in a position to execute orders for aircraft, aircraft parts and for any class of machine shop, sheet metal and wood work. Its plant is located in the center of an established aircraft community about one hundred feet from the Baldwin Station on the Montauk Division of the Long Island R. R. and may be reached in forty-five minutes from New York City. In addition to having an ideal railroad location the plant is at the junction of two highways and about midway between Mineola and Far Rockaway, consequently both land and water machines can be conveniently received and delivered by air.

Mr. William F. Bennett, formerly Secretary and Treasurer of the Lewis and Vought Corporation, is President of the Baldwin Aircraft

Corporation and Mr. John I. Rooney, recently Engineer and Production Manager of the Chance Vought Corporation, is General Manager.

A New Curtiss Aviation School

During the last two years the Curtiss Company has felt a growing demand for a flying school which would not only teach a man to solo, but would give him a chance to acquire enough time after his preliminary training to give him experience. It is a recognized fact that a young man of average ability and intelligence, in proper physical condition, can learn to fly sufficiently well to handle a machine in safety in a period of six to ten hours of flying instruction, and it is this instruction that commercial schools have been able to give. However, to send a pilot on a commercial job with this amount of training is suicidal, and no commercial company would consider employing him. Consequently, there has been little incentive for a young man to attend a flying school under these conditions (if he knew them) and the problem has been to supply this fifty hours of flying in which a student can acquire the experience necessary to make him a capable pilot without too great expense. To date no school has been able to do this, and few students are able to afford the three thousand dollars that such training would cost.

With this in mind, the Curtiss Aeroplane and Motor Corporation has arranged, through the Curtiss Exhibition Company, to operate its Aviation School at Garden City, L. I., offering the following inducements to students with the idea of solving the above problem:

A flying course in ten hours.

Eight weeks intensive training in aeroplane mechanics and its auxiliary subjects.

A complete Radio course.

Presentation to graduates of a JN aeroplane equipped to take OX motor, less motor.

The cost of the complete course, including flying training and the aeroplane, will be five hundred dol-



The Loening Air Yacht for the Wright Aeronautical Corporation. The illustration also shows the Engine Doorway to the Loening Factory, which enables shipment without taking down the Machines

motors are available throughout the country at reasonable prices, so that at a minimum cost a student can get his preliminary training, together with an aeroplane, on which he can acquire the experience mentioned above, at the cost of his gas and oil, and become a pilot capable of demanding a good position. In fact, after a little practice, he will be able to use his machine for passenger carrying, advertising, etc., with a good chance of fair profit together with his training.

A part of the work in the school will be the reconditioning of the machine and overhauling of motors by the students themselves under competent supervision. This will familiarize them with their own machines and give them practical training that no other method could give.

Furthermore, classes will be given to a limited number in aeroplane and motor work alone, at a cost of one hundred dollars, and those attaining the required standards will be placed in the Curtiss Organization. Plans are under way for a Club where the students can get room and board at minimum rates.

The Curtiss Company believe that this scheme will fill a long felt want and will go a long way towards popularizing and commercializing aviation.

Woman Buys First Aerial Commutation Ticket

The unique distinction of being the first woman to purchase an aerial flight commutation ticket has fallen to Miss S. D. Winter, sales manager of the Motor List Company of Cleveland.

Miss Winter's main office is in Detroit and she has occasion to go over to the Michigan City two or three times a week. Several days ago friends persuaded her to try the aerial route and she flew over in the "Wolverine," eleven passenger flying boat; one of a fleet now being operated by the Aeromarine Airways on a daily schedule between this city and Detroit. Upon the completion of her first aerial voyage, Miss Winter asked the passenger agent of the company if she could purchase a commutation ticket at a special rate. The regular fare for the round trip is \$75. The passenger agent recently issued her a ticket at the Aeromarine Booking Office in the main lobby of the Hollen-

den Hotel. This ticket calls for 14 round trip flights at the special rate of \$50 per round trip.

When asked why she had chosen the air route Miss Winter said:

"Time is a great element in my business. It did not take me long to realize that I could save practically one day and two nights by flying over to Detroit and returning the same day. And there is another angle to it too—I tell my prospect that I just flew in to get his order and I generally get it."

The double daily flying boat service between Cleveland and Detroit is being well patronized by the citizens of both Lake cities.

WRIGHT E-2 ENGINE TEST

As a result of a recent test conducted on an E-2 Wright engine, the Navy Department announced the possibilities of a marked increase in the power and dependability of aeronautical engines designed for use in scouting-type planes.

The test was held at the Anacostia Naval Air Station. The engine ran through 250 hours with the throttle open. The demonstration, it was said, may pave the way for all aviation engines not only to pass through long periods of running but to do so with their full rated power.

The department considers the feat of great importance in lengthening the range of scout planes and increasing their dependability to make an extended reconnoissance and return to their battleship base. The planes which are catapulted from the decks of battleships are equipped with the Wright engines.

M. A. A. Elects Officers

At the Annual Meeting of the Manufacturers Aircraft Association, Inc., the following directors were elected: A. H. Flint, L. W. F. Engineering Co., College Point, L. I.; F. L. Morse, Thomas-Morse Aircraft Corporation, Ithica, N. Y.; F. B. Rentschler, Wright Aeronautical Corporation, Paterson, N. J.; J. K. Robinson, Jr., Gallaudet Aircraft Corporation, East Greenwich, R. I.; F. H. Russell, Curtiss Aeroplane & Motor Corporation, Garden City, L. I.; I. M. Uppercu, Aeromarine Plane & Motor Company, Keyport, N. J.; J. G. Vincent, Packard Motor Car Company, Detroit, Michigan; C. M. Vought, Lewis & Vought Corporation, Long Island City, L. I.; G. M. Williams, Dayton Wright Company, Dayton, Ohio.

Officers were elected as follows:

President, G. M. Williams; Vice-President, F. B. Rentschler; Secretary, Chance M. Vought; Treasurer, F. H. Russell; General Manager and Assistant Treasurer, Samuel S. Bradley.

Remarkable Piston Ring Sales

The fact that The Piston Ring Company of Muskegon, Michigan has only been going after replacement business for less than a year, attaches special significance to the recent production record of 5,232,031 QUALITY Piston Rings during two consecutive working months. Although the Piston Ring plant is the largest exclusive piston ring factory in the world with its capacity of 12,000 rings per working hour, there is every reason to believe that further expansion will soon be necessary to keep abreast of the ever-increasing demand for QUALITY Piston Rings.

500 Civilians Learning How to Fly

According to reports compiled by the Aeronautical Chamber of Commerce, approximately five hundred persons are being taught to fly at the score or more of flying schools located in various parts of the United States. Among the leaders in civilian flying instruction are New York, Chicago, Dayton, Ohio, San Francisco, and points in Missouri, Oklahoma, and Texas. Most significant returns are found in Dayton, Ohio, "The birthplace of the airplane", where at the field of the Dayton Wright Company, 4000 inquiries have been received this summer from civilians who are desirous of learning the requirements and cost of instruction in flight.

No Chicago Meet This Year

Under the date of August 26th the Chicago Aeronautical Bureau advises Aerial Age as follows:

"We regret to be compelled to advise you that causes beyond our control have made it necessary to postpone until next year the Air Program originally scheduled to be held in Chicago from August 4th to 13th, inclusive, under the auspices of the Chicago Aeronautical Bureau.

"Believing you will be interested in knowing the reasons for this postponement we wish to explain that formal permit has been issued by the South Park Commissioners for the use of Grant Park on the

Grant Park which had temporarily been held in abeyance for us could not be longer delayed, and this work made it impossible for a considerable time to use the space set aside for a landing field.

"As we consider Grant Park the only place in or near Chicago where such a Meet could be successfully held, we were reluctantly compelled to abandon our plans until next year. The Chicago Aeronautical Bureau will commence preparations in February, 1923, for the holding of its Air Pageant during the first two weeks in August. With plenty of time and money at our disposal we expect to make it the greatest affair of its kind ever held. It will include not only a large number of flying events with liberal cash prizes, for the various classes of planes, but also an exhibition of aircraft and aircraft parts and material, as well as an Aeronautical Congress with addresses by the country's foremost authorities on the various phases of aeronautics.

"In the meantime the Chicago Aeronautical Bureau (incorporated not for profit) will actively continue its work in educating the public to the commercial possibilities of aircraft and in advancing

Chicago's aeronautical interests in every way.

"We wish to thank you for the interest you have shown in the plans for our Air Program, and will advise you fully as soon as the dates are definitely fixed for next year, when we hope to have you with us."

Frostburg Landing Field

The city of Frostburg, Md., has established and improved, at considerable labor and expense, a landing field about $2\frac{1}{2}$ miles southeastward of that city. The improved part of the field as it now stands is 1,200 feet long by 1,000 feet wide, having sufficiently clear approaches to make it available for most of the present type planes.

The field is marked by a circle, 100 feet in diameter, with a band 3 feet wide, painted white. This marker indicates the center of the best landing area. A wind cone has been erected to indicate the direction of the wind.

The location of this field at Frostburg, in the center of a country where landing fields are few, is an important addition to the model airway, located as it is midway between Washington, D. C., and Moundsville, W. Va.

Approximate position, latitude $39^{\circ} 40' N.$, longitude $78^{\circ} 65' W.$

Oxygen Instruments

This report (No. 130), by F. L. Hunt, of the National Advisory Committee for Aeronautics, contains an introductory discussion of the physiological effects of the lack of oxygen at high altitudes and the amounts required to be supplied artificially to aviators under normal conditions of flight. It discussed in detail the various types of aircraft oxygen apparatus which have been designed and used not only in this country, but also in England, France, and Germany. Instruments of both the compressed oxygen and liquid oxygen type are considered.

Methods of testing oxygen apparatus used at the Bureau of Standards are also fully described and the quantitative results of tests of sample instruments of different types are given.

A copy of Report No. 130 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D.C.

The Pressure Distribution Over the Horizontal Tail Surfaces of an Aeroplane, III

Report No. 148 by F. H. Norton and W. G. Brown, of the National Advisory Committee for Aeronautics, deals with the distribution of pressure during accelerated flight of the full-sized aeroplane, for the purpose of determining the magnitude of the tail and fuselage stresses in stunting.

As the pressures to be measured in accelerated flight change in value with great rapidity, it was found that the liquid manometer used in the first part of this investigation would not be at all suitable under these conditions; so it was necessary to design and construct a new manometer containing a large number of recording diaphragm gauges for these measurements. Sixty openings on the tail surfaces were connected to this manometer and continuous records of pressures for each pair of holes were taken during various maneuvers. There were also recorded, simultaneously with the pressures, the normal acceleration at the center of gravity and the angular position of all the controls.

The present investigation consisted in measuring on a standard rigged JN4H aeroplane the distribution of pressure over the whole of the horizontal tail surfaces while the aeroplane was being put through maneuvers as violently as it was thought safe, including spinning and pulling out of dives.

A copy of Report No. 148 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.



The booking office of the Aeromarine Airways in the Main Lobby of the Hollender Hotel, Cleveland.

ARMY *and* NAVY AERONAUTICS

Marine Corps Demonstrates.

A demonstration of the work of the 4th Air Squadron, U. S. Marine Corps, before a distinguished party of guests was held at Bowen Field, Port-au-Prince, Republic Haiti, during the early part of August, and illustrated the important part that aviation has come to play in the work of policing the troubled parts of the Caribbean.

The party in honor of whom the exhibition was given included The U. S. High Commissioner to Haiti, the President of Haiti, and his cabinet, the Chief Justice, the Chief of the Gendarmerie D'Haiti, the Chief of the Engineers and the Sanitary Service and the Mayor of Port-au-Prince.

The program included a formation flight of D H 4 B's, a demonstration of the use of the ambulance plane attached to the squadron, radio communication with plane in the air, practice bombing and gunnery flights, parachute jumping, and an exhibition of stunting and a "dog fight" between two J N planes.

The exhibition was staged in the presence of an audience of two thousand persons.

The unsung praises of the Marine Aviation units in Haiti and San Domingo does not affect the fact that this important branch of the service has done and is doing an important work in the far flung reaches of the tropical jungle toward the establishment of peace and good order.

The airplane patrol established over the island republics has been the means of seeking out and checking incipient revolutionary movements in numberless instances in a manner that would have been well nigh impossible through the use of scouting units of infantry. As a means of communication between widely separated posts throughout the island the aviation have proved invaluable. And in addition to the military uses of the airplane the ambulance service established by air through the use of a specially equipped ambulance plane has brought to the service of outlying posts the last word in speedy medical assistance and has been the means of

saving lives not only of members of the expeditionary forces but of any and all who might have need of medical assistance.

Conclusion of R.O.T.C. Students' Camp at Mitchel Field.

Twenty-three R. O. T. C. students from the Massachusetts Institute of Technology, who have been in camp at Mitchel Field for the past six weeks, departed from that station on July 26th. Major J. C. McDonnell and Captain Wm. B. Wright, Air Service, who were in duty at this station in connection with this camp and who have been for the past year instructors in the R. O. T. C. Unit of the above institute, remained at Mitchel Field to assist in the training camp for Reserve Officers which was already in progress at the conclusion of the R. O. T. C. Camp.

New Altitude Record in Bombing Machine.

Ascending to an altitude of 23,350 feet in a Martin Bomber, Lieut. Leigh Wade, test pilot at McCook field, Dayton, Ohio, broke his own altitude record made several months



An interesting Group at the Gordon Bennett Balloon Race at Geneva

ago for an airplane carrying three passengers. Lieut. Wade performed his latest feat on August 1st., and he was accompanied by Captain A. W. Stevens, aerial photographer, and Sergeant Roy Laugham, observer.

The bomber was equipped with a Moss supercharger.

Contrary to most altitude trips, this flight was without any unusual incident. The temperature was slightly below zero, while a wind, estimated at 100 miles an hour, was recorded. The flight took 2 hours and 15 minutes. One hour and 52 minutes elapsed before the ship reached the ceiling, while only 23 minutes were required for the return trip.

Lieut. Wade believed that with several minor adjustments he can climb the Bomber to a higher altitude.

Aerial Observation School Makes Fine Record.

The most thorough course in flying ever given to any Air Service class terminated at the School for Aerial Observers, Post Field, Fort Sill, Oklahoma, on June 30, 1922.

The course opened January 16, 1922, with 3 Captains, 11 First Lieutenants, one cadet from the Regular Army and one foreign officer, Lieut. Shen from the Chinese Navy. The only changes in personnel during the course were as follows: On February 14th, Cadet Wright crashed and was killed; on March 15th Lieut. Zuniga Cooper, of the Chilean Army, was transferred to the Observation School from the Communications School; and on April 12th Lieut. R. L. Williamson was assigned to the School from Carlstrom Field. On June 30th the School graduated 15 regular officers and two foreign officers.

The subjects covered in the course were Liberty Engines, Rigging, Artillery, Contact, Photography, Visual Reconnaissance, Radio, Army Regulations, Infantry Contact, Minor Tactics, Rules of Land Warfare, Gunnery and Flying. The technical part of the course was given in the Rigging and Motor Shops, and the theoretical part in the class rooms.

The remarkable thing about the course was that, in spite of the great number of flying hours, there was only one fatal accident, and that occurred in the early stages of transition work.

Night Flights of the Airship C-2.

The night flights recently made by the Airship C-2, one from Aberdeen, Md. to Philadelphia, Pa., and return, and the other from Bolling Field,

Anacostia, D. C., to New York City, and return to Aberdeen, served as an ample demonstration of the ability of airships of this type to successfully negotiate long distance flights despite unfavorable weather conditions, and that they can be navigated sufficiently close to the ground to pick up lights and land marks under such conditions, even when confronted by fog and rain, with relative safety to the passengers on board and to people on the ground.

The first trip, the purpose of which was to make a night practice flight in order to give the crew some good experience in handling the ship at night preparatory to the trip to New York City, and at the same time to test the new type of bomb rack which is being installed on the ship, was started from Aberdeen Proving Grounds at 6:00 p.m. The crew on board consisted of Major James A. Mars, Captain W. E. Kepner, 1st Lieut. E. S. Moon, Lieut. R. J. Parker, R. O. T. C. and Sergeant A. D. Albrecht. The bombing was conducted from an altitude of 2,000 feet, dummy bombs being used, one weighing 300 lbs. and the others 100 lbs. The bomb rack functioned satisfactorily.

Upon concluding the bombing practice, the ship proceeded on a cross country flight to the Delaware River, and thence up this river to the vicinity of Philadelphia, Pa. It returned via the same route and arrived at Aberdeen shortly after 11 p.m.

In the early evening and for some time after dark, land marks were easily discernable, but around nine o'clock a thick fog was encountered. The wind was quite dusty and rain fell at intervals. At times land marks were very hard to distinguish, and only a few lights were visible. It was necessary to steer entirely by compass, but the course was held very accurately. The radio apparatus on board functioned splendidly, and communication with the Aberdeen Proving Grounds was maintained practically during the entire time of the flight.

The appearance of the ship at night over the various cities and towns en route apparently created considerable excitement, as evidenced by the flashing of small searchlights and the burning of some flares at various times, evidently for the purpose of attracting the attention of the aeronauts. The trip was made in a northeast wind, which was blowing at the rate of about 15

miles an hour, at times rising to higher intensity, the average altitude maintained being between 1,000 and 1,200 feet.

In commenting on the trip, Major Mars stated that altogether it was very enjoyable and instructive practice flight, and he sees no reason why a ship of the C-2 type should not operate very successfully at night under average conditions.

On the following day, the C-2 took off from Bolling Field at 4:30 p.m. and arrived in New York City at 11:30 p.m., standard time. Very good visibility was had while over Philadelphia, and the ship flew over the Quaker City about 20 minutes. After passing Trenton, N. J., heavy fogs and rain were encountered. Flying across the mouth of upper New York Bay at about 600 feet altitude, the lights of the bay could not be seen, and it was not until Coney Island was reached that any lights were picked up. The ship next flew over New York City at an altitude of 500 feet, but again fogs were encountered and the lights of the city could not be seen. It hovered over the city for about one and one-half hours, being alternately in and out of the fog, and while circling the Statue of Liberty it was picked up by the searchlights at this point.

The radio apparatus on board functioned until Trenton was reached, so that while the C-2 was over in New York City no radio communication was possible.

The return to Aberdeen was made without incident and the ship landed at 5:30 a.m. July 28th.

An Aviation Beacon

A representative of the Lawrence Sperry Aircraft Corporation recently visited McCook Field, Dayton, Ohio for the purpose of demonstrating a connection with night flying a new truck and searchlight combination known as the Sperry Duplex Truck. The purpose of this light is to serve as a beacon to mark landing fields for night-flying airplanes. The light which is of high intensity (three hundred million candle power), with reflector measuring 36 inches in diameter, is the same type as that used on battleships at sea, but this is its first adoption for land purpose. By its radiation a landing field should be located from 75 to 100 miles away. The engine of the truck performs double duty, serving as power for the truck when in motion and for the searchlight when the truck is still.

REVIEW of WORLD AERONAUTICS

A Million Kilometers Without Accident.

One million kilometers (621,370 miles) of flying with passengers, freight and mail were completed by the Royal Netherlands Aeroplane Company on July 22, 1922, says consul Mahin, Amsterdam, in advices to the Department of Commerce.

Not a single accident has occurred, the consul reports. This company has a daily service between Amsterdam and Paris and a twice a day service between Amsterdam and London. The distance over each of these routes is approximately 300 miles.

Cross Channel Traffic.

The returns of air traffic on the cross-Channel routes to Paris, Brussels and Amsterdam, during the three months April-June, are now available from the Air Ministry.

During this quarter 764 machines departed from the London Terminal Aerodrome, Croydon, and 768 machines arrived, the total number using the aerodrome on Continental services being 1,532. This is a considerable increase on the figures for the same period last year, when 506 machines departed and 495 arrived.

The majority of machines were of British nationality, belonging to the Handley Page Transport, Ltd., the Instone Air Line, and Daimler Hire, Ltd. The figures by nationality are:—British, 915; French, 228; and Dutch, 189. Last year British machines numbered only 246 out of a total of 1,001 machines using the aerodrome.

The total number of passengers carried during the period was 3,128, and is a slight decline on the total of 3,565 carried a year ago. The proportion carried by British companies has, however, greatly increased, 2,402 travelling in British machines against 1,653 in the same period last year. British traffic therefore amounted to 76.8 per cent. of the total, whereas last year it was only 46.4 per cent.

The total weight of goods carried by aircraft to and from Croydon was 144 tons, which is a large increase on last year, when the figure was 56.9 tons. Half of this total was carried by French machines, but the British share of the traffic shows the largest proportionate increase, 53.6 tons having been transported by British machines against 4.9 tons a year ago.

The efficiency of British air service continues to be of a high standard. In April the efficiency of flights made and completed within four hours by British machines on the London-Paris route was

92.3 per cent. For May the figure was the same, and for June it rose to 95.2 per cent. The figures for French machines during the same period on the same basis were:—April, 71.3 per cent.; May, 85 per cent.; and June, 79.1 per cent.

Notwithstanding these figures it has to be noted, however, as stated in the last half-yearly report on Civil Aviation, that a considerable increase in traffic is essential if Air Transport firms are to obtain a commercial basis of operation, the passenger accommodation occupied on British machines being only 37 per cent. in April, 30 per cent. in May, and 31 per cent. in June, and the useful cargo capacity used only 44 per cent. in April, 44 per cent. in May, and 40 per cent. in June.

Italian Airplanes and Airships in Brazil.

The Minister of War, Hon. Soleri, has decided to send a series of the most modern airplanes and hydroplanes to the International Exposition of Rio de Janeiro.

He has also decided to send several types of small airships, that have been experimented with success, during the last stages of the war and after the Armistice.

The planes will be furnished by the Army and will be piloted by Aviators of the Air Service.

The Hon. Soleri has forwarded a circular to all the Italian Constructors of Airplanes and Airships inviting them to send the most modern types of planes to the Capital of Brazil, in order to uphold the prestige of Italian Aviation.

Napier Performance.

The Napier-engined D.H. 34 machines at present used by the Daimler Airway

Company carry out a double return journey between London and Paris each day, and during the month of June for the first time in one week this double return journey was made each day for five days by the same engine and machine, and it says much for the reliability of the 450 h.p. Napier engine that at the end of the week—after having completed 4,600 miles in that week—it was running as smoothly and efficiently as ever.—London Financial TIMES.

France—Spain Postal Service.

It is announced that the Spanish Government has given its consent to the inauguration of an aerial postal service between France and Spain. An agreement is being drawn up between the Spanish Government and the Latecoere Company, which will undertake the transport of mails to and from Spain by utilizing the airplanes already plying on the Toulouse-Casablanca route, which land at Barcelona, Alicante and Malaga. It is also likely that an agreement will be made with regard to the transport of goods by air between France and Spain.

Danish Progress

The Danish Airship Co., having obtained official guaranty for one-half of a possible deficit, is arranging express traffic connections with Central Europe. The company is to take certain mail in exchange for the Government's promise of assistance.

The daily service to Hamburg can take 300 kilos of freight or three passengers, but the route is established only with the idea of taking freight and mail. Germany will furnish three and Denmark three of the machines used on the Copenhagen-



International Air Traffic Association in Convention at Copenhagen, Denmark

Hamburg line. The Danish planes are rebuilt and improved DeHavillands.

Another air route, embracing Essen, Brussels, London and Paris, is expected to be opened the 1st of July.

Bristol Performance.

Remarkable results have been achieved in Paris during the tests of an English aero engine by the French Air Ministry. The engine is the 400 h.p. "Bristol" Jupiter radial air-cooled engine, and the performance and reliability shown has never been equalled in France. For five periods of non-stop runs, during which, according to the French official report "the engine behaved itself perfectly and there were no replacements of any sort". For half an hour at the beginning of each period the engine was run at full power—in each case over 400 HP and at nine-tenths full power for the remainder of the period.

These results are the more remarkable when one reflects that if the engine were fitted to an aeroplane, each non-stop period represents over 1,000 miles of travel.

Some few months ago it was recorded that the Jupiter engine had passed the 50 hours endurance tests laid down by the British Air Ministry—the first air-cooled engine to do so.

The French, always keen judges of purposes the tests mentioned were called interested and soon afterwards it was announced that the largest aero engine makers in France, the Gnome & Rhone Company, had obtained the constructional rights for France and neighbouring countries.

Before acceptance for French official purposes the tests mentioned were called for. To the official report is added the remark that the 50 hour period of test might have been doubled so far as the engine is concerned.

These results have been achieved by the makers, the Bristol Aeroplane Co. Ltd. after nearly four years of unflagging research and experiment. The fact that they have now evolved an engine of 400 h.p. weighing only about 1¾ lbs. per h.p. and of unequalled reliability marks an epoch in aviation. The engine is already used in certain of the aircraft seen by the public at the Aerial Pageant and this number will doubtless be increased. Commercial machines with this power unit are also in construction.

British aero engines have deservedly gained a reputation as the finest in the world and the success of the Jupiter engine in France adds yet another link to the chain.

A Siddeley Success.

The Armstrong-Siddeley 325 h.p. radial air-cooled engine known as the Jaguar has just very successfully completed its official Type Test under Air Ministry observation. This particular test was made under

the new regulations which call for the whole of the 50 hours' test being made in 10 hour non-stop runs and the Jaguar is the first air-cooled engine—if not the first engine of any type—to pass the British tests under this rule.

The performance on test was most satisfactory, and both fuel and oil consumption were extremely good. Full details of the test and a description of the engine will be given in the immediate future.

Aeronautical Map of Italy

The Secretary of State, recognizing the need of an aeronautical map of the Kingdom, that would offer informations and exact references to aerial navigators; considering that only a public contest would give the best results; hearing the opinion of the Council of State; decides:

Art. 1-To ban a competition for the edition of an aeronautical map of Italy. The conditions are fixed on this brief. All the Italian citizens can participate to the contest.

The following prizes have been assigned to the contest:

- 1st. prize-Lire 20,000
- 2nd prize-Lire 10,000
- 3rd prize-Lire 5,000

Art. 2-The contestants will have to present the original or the lithographic production of the sheet of the future aeronautical map of Italy and precisely the one comprised between 8° and 9° of longitude East Greenwich, 45° and 46° of northern latitude. Said sheet should be countermarked with a motto and addressed to the Ministry of War Superior Command of Aeronautics: Civil Service Section with a sealed envelope bearing the same motto, enclosing a card with the name, surname, paternity, address of the contestant and again the distinctive motto.

Art. 3-The time for presenting the work expires October 31st, 1922. All the works delivered after such date will be returned.

Art. 4-The examination jury will consist of: the Director of the Geographical Military Institute, of a delegate of the Hydrographic Institute of the Royal Navy, a representative of the Aeronautical Inspectorate of the Royal Navy and an authorized member of the National Sport Associations.

Art. 5-The works which will be awarded prizes will become the exclusive property of the Military Administration, who will use them for the edition of the aeronautical map of Italy, making if necessary, changes and additions so that the map will answer better the purpose destined to. The other works will be returned to the owners.

Caproni Metal Plane.

The Caproni firm announces that they have completed a new type of an all metal aeroplane.

This news has met with great favor in

the Italian aeronautical circles.

It is said that the public experiments with the new Caproni will be made soon.

Germany's Reply to Restrictions

From Berlin it is reported that the German Government has sent a note to Denmark, Norway, Sweden, Holland and Switzerland informing the respective governments that only aeroplanes conforming with the restrictions placed upon German aircraft will be permitted to cross the German frontier. This is a clever move on the part of the German Government, and obviously intended to reduce the handicap which the restrictions of the Allies places upon German civil flying. If any of these countries wish to run services into Germany they can now only do so by using machines of as low power and fuel capacity as those to which the Germans themselves are restricted.

500-Aeroplane Fleet Planned by Britain

With no limitation of air armaments in sight, Great Britain now plans to build a fleet of 500 aeroplanes for home defense. Critics of the extension of the air fleet regard it as putting a premium on air armaments.

Premier Lloyd George announced this big building program in the House of Commons, saying the decision to do so resulted from an inquiry by the Committee on Defense of the Empire. At the present time Britain has thirty-one squadrons, only twelve of which are in the British Isles. France, however, will have at the end of next year fully 220 squadrons, besides several hundred machines which can be drawn from civil aviation in the event of an emergency. It will cost nearly \$10,000,000 annually to maintain the new British home defense air force.

The Premier indicated that if necessary there would be a further extension of the air service. It is understood orders for aero engines will be divided among five firms.

Aerial Mail from Germany to Russia

The aerial mail service initiated on May 6 from Hamburg via Stettin to Danzig, Königsberg, Kovno, Riga, and Moscow, has made a marked reduction in the time required for delivery of mails between Germany and Russia, according to recent dispatches from Consul Huddle, Hamburg. The saving amounts to 24 hours in mail for delivery to Kovno, and 36 hours for mails to Riga. In addition there is a saving of 5 hours time in the Danzig and Königsberg mails.

A daily service from Hamburg to Kovno is maintained, and from Kovno to Riga the trips of the mail planes are on Tuesdays, Thursdays, and Saturdays. From Königsberg the planes leave on Thursdays and Sundays to Moscow, the flying time to Moscow being in the neighborhood of 37 hours.

ELEMENTARY AERONAUTICS and MODEL NOTES

THE "COOK 42" HYDRO

THE "Cook 42," designed by Ellis C. Cook, second prize winner in the National Model Aeroplane Competition for hydros and duration record holder for twin-screw hydros, is constructed along orthodox lines. Although designed in the winter of 1914-1915 it was not completed until just prior to the hydro competition. It is of the common "A" frame design with the 1-1-0 P2 wing and propeller arrangement. The float system is of the familiar 0-2-1 system. The model is fairly light, weighing, when complete, 3.33 ounces, of which 1.2 ounce is rubber motor.

Frame and Chassis

The frame is built up of two white pine strips $38\frac{3}{4}$ " long and $5/16$ " x $1/8$ " in cross section. They taper towards the ends where they are only $1/8$ " and $3/16$ " high in the front and rear respectively. The strips are braced by three "X's" made of $3/16$ " x $3/64$ ", streamlined. These prevent any bending tendencies in a sideward direction. The propeller bearings are small streamlined forgings of light weight. They are bound to the frame with thread and sealed with a celluloid solution. The front fork is made of No. 16 piano wire bound to the frame.

The chassis holding the floats is made of $3/32$ " bamboo bent to shape and bound to the frame. The floats are attached to the chassis by rubber bands, the angle of the front floats being adjustable.

Wings

The main wing has a span of 36" and a chord of 5". It is constructed of two white pine beams 30" long with bamboo wing ribs. The ribs, seven in number, are also of bamboo and are spaced $4\frac{1}{2}$ " apart. The motor, or front plane, has a span of 14" and a chord of $3\frac{1}{2}$ ".

The framework of this wing is entirely of bamboo. The entering edge is given a slightly greater dihedral than the rear edge, so that the angle of incidence at the motor is slightly less than it is at the tips. In this manner the added incidence at the front plane is obtained. Both wings are fastened to the frame with rubber bands.

Floats

The two front floats are spaced 8" apart and are of the stepped type. The step is $1/4$ " from the front and is $1/8$ " deep. The two front floats are separated by two bamboo strips tied to the rounded portion of the under-carriage by small rubber bands. Sliding these strips back and forth, the

angle of the floats may be altered to suit conditions.

The floats are built up of two pieces of very thin pine for sides, separated by small pieces of wood about half the size of a match in cross section. The floats and wings are covered with chiffon veiling waterproofed with a special preparation. This makes a watertight and strong construction without any undue weight.

Power Plant

The two ten-inch propellers with which the model is equipped have a theoretically twelve-and-one-half-inch pitch. They are carved from blanks $1/2$ " thick and have blades with a maximum width of 1" at a radius of 3". The shafts are made of No. 16 piano wire, and have small washers for bearings.

Each propeller is driven by three strands of $1/4$ " rubber. The rubber is given about 1,700 winds, and turns the propellers at 1150-1200 R. P. M. when in flight. When not in flight the R. P. M. is considerably less, or about 750.

When in flight the model seems to be somewhat overpowered, although this is not the case. It takes but two or three feet of run to leave the water, and climbs at a very steep angle to an altitude of about 125 feet. The motors unwind in 85-90 seconds, the glide making up the rest of the flight. From a duration standpoint its flights have been very consistent out of six timed flights, four have been between 98 and 100.6 seconds, which is somewhat unusual for a model which makes good duration.

Characteristics and data relating to some of the successful models of Illinois Model Aero Club members:

	Name of Designer and Type of Machine			
	Cook Hydro	Hittle Hydro	Schweitzer Duration	Pease Duration
Wing area (sq. ft.).....	1.39	1.5	.92	.92
Total weight (ozs.).....	3.33	1.75	1.96	1.61
Wing loading (wgt./area).....	2.4	1.17	2.13	1.75
Duration of flight (secs.).....	100	116	230.8	207
Weight of rubber (ozs.).....	1.2	.6	.88	.68
Resistance factor.....	4.5	8.75	7	6.3
Thrust, each propeller (lbs.).....	.37	.2	.14	.12
Propeller disk area (sq. inches).....	137	78.5	266	226
Air pitch speed (ft. per sec.).....	20	14.8	.....	10
Effective pitch (per cent.).....	63	59	.....	59
Revolutions of propeller.....	1700	1500	.....	.....
Lgth. of rubber (feet).....	3.33	3.1	3	3
Propeller diam. (inches).....	10	10	13	12

Reader of Aerial Age in South America Building Novel Gliding Machine.

From Uruguay, South America, a report has reached Aerial Age describing a

gliding or soaring plane being constructed by Hector Symonds, a novel feature of this glider which is nearing completion, is the employment of a small engine to give the wings a flapping motion. The design is copied from nature as far as possible, the Eagle being chosen as a model.

Calculations indicate a lifting force of 400 pounds. The dimensions are:

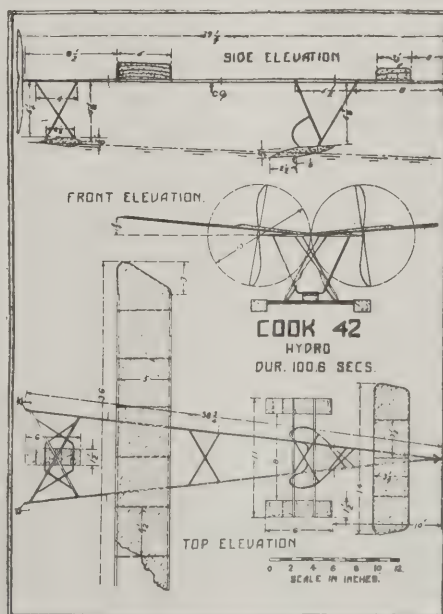
Wing spread, tip-to-tip.....42 feet
Length, tip of tail to nose.....15 feet
Height with wheels in position.....7 feet
Chord, (min. O Lt.,) maximum....10 feet
Incidence Angle, (variable) 0 to 10 degrees
Radius of Flap at wing tip.....8 feet
Weight per square foot.....1 1/2 pounds
Lifting surface of wings.....240 sq. ft.
Area of tail.....30 sq. ft.
Engine.....5 H. P.

Instead of using a propeller, flapping wings will be used, which is believed to be sufficient for "taking off." The engine will turn at 800 to 900 R. P. M., geared down to a crank turning at 30 r. p. m., to which the wings are attached.

Balancing in the air is to be accomplished by increasing the incidence of one wing while decreasing the angle on the opposite wing? Ascension to be made by increasing the angle of both wings, and descent by flattening the angle.

The Mechanical Properties of Metals

THE mechanical properties of metals may be most simply studied by considering the phases through which the



material passes when continuously loaded, say, in tension, until rupture takes place. Mild steel may be taken as an example.

If a steel bar is subject to an increasing load it at first stretches almost imperceptibly; if during this period the load be removed, it returns to exactly its original length. Thus it acts practically as an exceedingly stiff spring. During this phase it obeys "Hook's Law," which states that stress is proportional to strain. This law is usually written $f = Ed$ where f is the stress in pounds per square inch, d the strain expressed as a fraction of the original length, and E is the ratio termed the "Modulus of Elasticity."

Suppose that the load be continuously increased. A point is necessarily reached when the law breaks down. This is called the Yield Point. Up to the yield point the material is elastic, and on removal of the load reverts to its original size. Loads occasioning stresses beyond the yield point, however, cause the materials to take a permanent set.

A stress termed the Ultimate Stress, considerably greater than the yield stress, has to be applied before the material ruptures. Elongation between yield point and fracture may be considerable, depending upon the nature of the material. Failure finally occurs owing to local contraction at the weakest section.

A material which stretches considerably between the elastic limit and the point of ultimate failure is said to be ductile. This property is of great importance. Although the stresses in material under normal working conditions are well below the elastic limit, when excessive stretches occur which are liable to cause failure, the effect of ductility is felt. A ductile material has to give considerably before failure, and in so doing may avert failure by throwing part of its load on to other members of the structure.

Where sudden loads are anticipated ductility is essential. Cast metals as a rule have little ductility. They fail immediately after the yield point is reached.

The effect of stressing materials beyond their elastic limit is of interest. It is usually to harden them, that is, to raise the yield stress and to reduce their ductility. This effect is made use of in the manufacture of wire and sheet. These are rolled down from billets, the material being annealed from time to time to soften it. If the finished sheet is not finally annealed it will be much harder than the original material.

Fine steel wires may have an ultimate strength of well over 100 tons per square inch. Aluminum sheet likewise may have a strength of 15 tons per square inch, though the same material annealed would only stand 6 or 7 tons per square inch. A copper pipe that is bent or hammered is affected in exactly the same way. The ductility of materials can usually be restored by means of suitable heat treatment—steels by annealing, copper by quenching.

The effect of heat on the mechanical properties of metals is exceedingly important, particularly in the case of alloy steels. As working and heat have so great an effect on the properties of materials, care must always be exercised in subjecting parts to either. If a special steel axle tube, for example, be brazed, its mechanical strength at the point heated may be reduced by half.

When materials are subjected to constantly alternating stresses they become "fatigued." Engine parts are particu-

Latest List of Model Aeroplane Records

Supplementing previous lists of model aeroplane flight records published in Aerial Age, the list below gives the most recent records, corrected to the date of September, 1922. The list has been compiled by the Illinois Model Aero Club of Chicago, Ill., whose members have held the majority of records for several years past.

Some of these records will no doubt stand unbeaten for some time, but in many cases they can be equalled by those having the patience and skill acquired by I. M. A. C. members. The records are being

shattered one by one, for the I. M. A. C. members are not content to let the record stand for any length of time. This friendly rivalry evidenced in the spirit of this club is one of the principal factors promoting its growth which can well be adopted by the more recent model clubs.

The I. M. A. C. offers its assistance to all interested in the scientific sport of model flying, and further information in regard to records etc. is available to those who direct their inquiries to Mr. Warren H. DeLancey, Secretary of the I. M. A. C., Auditorium Hotel, Chicago, Illinois.

LIST OF WORLD'S RECORDS FOR RUBBER-DRIVER MODEL AEROPLANES

Type of model	Kind of contest	Record	Held by
Twin Pusher, Hand Launched.....	Duration.....	265 Seconds.....	R. Jarrett
Twin Pusher, Hand Launched.....	Distance.....	5337 Feet.....	Thomas H. DeLancey
Twin Pusher, R. O. G.	Duration.....	209 Seconds.....	R. Jarrett
Twin Pusher, R. O. G.	Distance.....	4029 Feet.....	W. Schwietzer
Twin Pusher, Hydro.....	Duration.....	172 Seconds.....	B. Pon
Tractor, Hand Launched.....	Duration.....	240 Seconds.....	D. Lathrop
Tractor, Hand Launched.....	Distance.....	2465 Feet.....	B. Pon
Tractor, R. O. G.	Duration.....	227.4 Seconds.....	P. Breckenridge
Tractor, R. O. G.	Distance.....	2685 Feet.....	P. Breckenridge
Tractor, Hydro.....	Duration.....	116 Seconds.....	L. Hitt
Indoor, Hand Launched.....	Duration.....	170 Seconds.....	B. Pon
Scale Model.....	Duration.....	21 Seconds.....	R. Jarrett

larly liable to fatigue. A constantly vibrating wire is another example. Alternating stresses much below the yield stress of the material cause a gradual crystallisation or coarsening of the structure of the material, which reduces its strength considerably and robs it entirely of its ductility. Provided that a sufficiently low stress is used, it appears that an indefinite number of alternations of stress are possible without ill effect.

The Orenco Fighter Model.

The Orenco Fighter makes a very pretty model, especially if all details are used in the construction.

A model of this machine was built from plans published in the March 14, 1921 issue of Aerial Age, by A. I. Mead of Norwalk, Conn. More detail has to be gone into in order to achieve a realistic appearance for exhibition purposes. The model having movable rudder, stabilizer and ailerons? The rubber and stabilizer being adjusted by screws from beneath the cockpit and the ailerons in the same manner.

The radiator, dummy motor and the top of the fuselage are of balsa. They are all removable as are the wings.

The motor stick is attached to the radiator, then making it easy to remove and repair the rubber band motor, which is composed of twenty-five feet of one eighth ($\frac{1}{8}$) inch flat rubber, driving a ten inch, four blade propeller. The two-blade propeller is used for exhibition purposes only.

Though weighing exactly one pound, complete, the model has made flights of

about one hundred and fifty feet at high rate of speed.

Enlargement of Activities at Chanute Field.

Chanute Field, Rantoul, Ill., is a busy place nowadays. Since the arrival of the Communication School from Post Field, Fort Sill, Okla., and the Photographic School from Langley Field, Va., the already busy routine of the post has been considerably enlarged. The question of room to be allotted to these various schools for purposes of instruction is somewhat of a problem, but is being met by the erection of additional steel hangers. One hanger has already been completed, and three others have been contracted for. The erection of several hangers in addition to this number is contemplated in the near future.

Among the new officers reporting at Chanute Field for duty with the Photographic School are Captain W. C. Wheeler, Air Service, Commanding; and 1st. Lieutenants Robert Cronau, J. P. Hodges, Stewart W. Torney and E. B. Robzien.

The school detachment consists of 25 enlisted men. With the exception of Capt. Wheeler, all of the above officers came by airplane, ferrying over photographic planes from Langley Field.

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(Continued from page 498)

effort should be made to plan for the future even if the immediate equipment is very modest. Although the aircraft industry is moving very slowly at present, it is growing nevertheless. There is no doubt that the tightness of funds, which came as a result of the war, has had much to do with the slowness of this growth.

The condition of financial stringency is passing and money rates are rapidly returning to normal. With money rates back to normal, those somewhat speculatively inclined will become dissatisfied with the usual low interest rates on gilt-edge investments. Such people may be expected to cast around for new investment fields offering greater returns, even if somewhat speculative, and the operation of aircraft on a comprehensive scale is very sure to attract their attention. At the same time, it has already been demonstrated that aeroplane transportation can be made to pay even on a comparatively small scale when properly managed. As the scale of operation is increased, with growing traffic, the revenue will increase very rapidly.

Considering all of this, it is by no means unlikely that the much-looked-for recovery of the industry will come suddenly when it does come.

A New School Group in the Air Service.

Orders have been issued creating a new group in the organizations of the Air Service, to be known as the 10th Group (School), to be located at Kelly Field, San Antonio, Texas, and to consist of the following organizations:

- 39th Squadron (School) Pursuit
- 40th Squadron (School) Bombardment.
- 41st Squadron (School) Attack
- 42nd Squadron (School) Observation
- 43rd Squadron (School) Service
- 13th Air Park
- 22nd Photo Section
- 10th Group Headquarters Detachment.

Major John N. Reynolds, Air Service, will be in command of this new Group, which is to form the Advanced Training School of the Air Service. In its organization, it is contemplated that each of the present tactical groups of the Air Service shall furnish the nucleus of the new squadron which is to carry on its specialized work in the school. With this in view, the 2nd Group (Bombardment), which has been transferred to Langley Field, Va.,

has left some 14 officers and 100 enlisted men at Kelly Field to form the nucleus of the 40th Squadron. The 1st Group (Pursuit), formerly at Ellington Field and lately transferred to Selfridge Field, Mt. Clemens, Mich., is transferring some 10 officers and 100 enlisted men to form the nucleus of the new 39th Squadron. The 3rd Group (Attack), Kelly Field, will furnish the nucleus of the 41st Squadron. Seventeen officers and 350 enlisted men are being transferred from Post Field, Fort Sill, Okla., to form the nucleus of the new 42nd Squadron, the 13th Air Park and the 22nd Photo Section. About 100 enlisted men are being transferred from the Lighter-than-Air branch (Brooks Field) to form the nucleus of the 43rd Squadron.

When the school group is completed, it is contemplated that the four different courses, which are now being given at three different stations, will be coordinated and fitted together in order that they may be given at one station. Pilots who graduate from this school will have good general knowledge of all tactical branches of the Air Service, as well as a very thorough knowledge of their own special branch.

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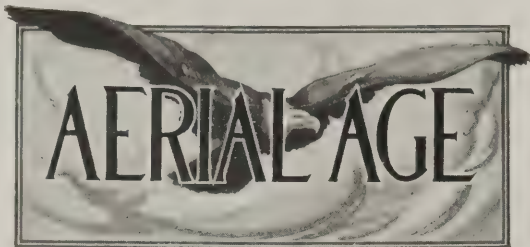
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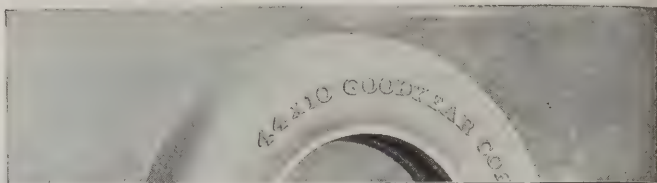
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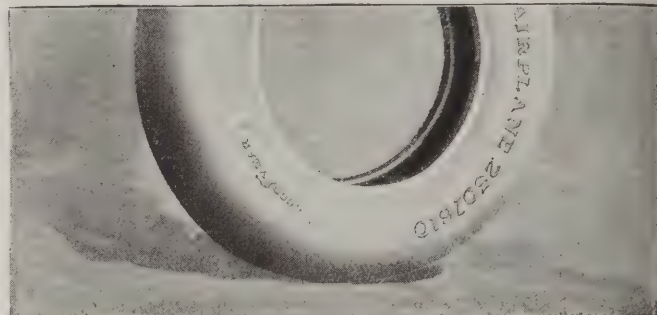
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World Records Established in Pulitzer Race

INTERNATIONAL aeronautic history was written at Detroit on October 14, when the year's aeronautic classic, the Pulitzer Race, was staged. The world's speed record was shattered by a good margin, and the Curtiss organization established a very unique record in having its ships take first, second, third and fourth place.

Having in mind the extraordinary speed attained by the contestants, another remarkable feature of the race was the entire lack of accidents. Several of the machines dropped out of the race, but no injuries were sustained by any of the pilots.

The order in which the pilots finished was as follows:

Lieut. Russell L. Maughan, army Curtiss racer, CD-12, 206.

Lieut. Lester J. Maitland, army Curtiss racer, CD-12, 203.

Lieut. Harold J. Brown, navy Curtiss racer, D-12, 193.2.

Lieut. Alfred J. Williams Jr., navy Curtiss racer D-12, 188.

Lieut. Eugene H. Barksdall, Sperry pursuit, Wright, 181.

Lieut. Fonda B. Johnson, Sperry pursuit, Wright, 178.

Capt. Corliss C. Moseley, Verville pursuit, Packard, 177.3.

Lieut. Eugene C. Whitehead, Loening pursuit, Packard, 170.2.

Lieut. La Clair D. Schulze, Loening pursuit, Packard, 160.9.

Capt. Clayton L. Bissell, Morse pursuit, Packard, 155.5.

Capt. Frank O. D. Hunter, Morse pursuit, Packard, 149.3.

The complete list of entries in the Pulitzer race was as follows:

Marine Corps: Capt. Francis P. Mulcahy, Thomas-Morse MB-7, Wright 400 horse-power.

Lieut. Lawson H. Sanderson, Chance Vought (mystery ship), Wright 400 horse-power.

Navy: Lieut. David Rittenhouse, Booth BR-W, Wright 400 horse-power.

Lieut. Stephen W. Callaway, Booth BR-1, Wright 400 horse-power.

Lieut. Alfred J. Williams Jr., Curtiss No. 1, Curtiss 400 horse-power.

Lieut. Harold J. Brown, Curtiss No. 2, Curtiss 400 horse-power.

Army: Lieut. Corliss C. Moseley, Verville HSP, Packard 600 horse-power.

Lieut. R. L. Maughan, Curtiss HSP, Curtiss 375 horse-power.

Lieut. Leslie J. Maitland, Curtiss HSP, Curtiss 375 horse-power.

Lieut. E. C. Whitehead, Loening HSP, Packard 600 horse-power.

Lieut. L. A. C. D. Schulze, Loening HSP, Packard 600 horse-power.

Capt. Frank O. D. Hunter, Thomas-Morse HSP, Packard 600 horse-power.

Lieut. Clayton L. Bissell, Thomas-Morse HSP, Packard 600 horse-power.

Lieut. E. H. Barksdale, Sperry HSP, Wright 350 horse-power.

Capt. St. Clair Street, Sperry HSP, Wright 350 horse-power.

Lieut. Fonda B. Johnson, Sperry HSP, Wright 350 horse-power.

Capt. Albert M. Guidera, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. Benjamin R. McBride, Thomas-Morse MB-3 Wright 300 horse-power.

Capt. H. M. Elmendorf, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. Donald F. Stace, Thomas-Morse MB-3, Wright 300 horse-power.

Capt. Oliver W. Broberg, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. James D. Summers, Thomas-Morse MB-3 Wright 300 horse-power.

Lieut. Thomas K. Matthews, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. George P. Tourtellot, Thomas-Morse MB-3, Wright 300 horse-power.

The abbreviation HSP, means high speed pursuit.

The story of the race by Frederick Pasley, staff correspondent of the New York World gives an excellent impression of the spirit of the race.

It was a race without a spill. There were four forced landings but all planes were brought down under control. Contrary to the expectations of the thousands who journeyed to Selfridge Field, every pilot who went up came down safely.

It was a personal triumph for Glenn H. Curtiss. He is established beyond cavil as the world's foremost aeronautical engineer. His judgment on wing radiation and stream lining has been completely vindicated.

So certain were army officials of what his ships would do that they withdrew the eight Thomas-Morse MB-3 planes a few hours before the race. They were flown early in the day for the Mitchell Trophy, donated by Brig. Gen. William Mitchell in memory of his brother, who was killed in France.

Of the other Pulitzer entrants Lieut. David Rittenhouse, navy pilot of the Booth racer, withdrew because of engine trouble before taking the air.



The Army-Curtiss Racer, winner of the Pulitzer trophy, and its pilot Lieut. R. L. Maughan



The TR-1 Naval Seaplane, winner of the Curtiss Marine Flying trophy, equipped with Lawrance radial engine piloted by Lt. A. W. Gorton

Capt. Francis B. Mulcahy of the United States Marine Corps, piloting the Thomas-Morse MB-7 overhead wing monoplane, was forced out after completing two laps because of overheated oil in the lubricating system. He was averaging about 140 miles an hour.

Lieut. Lawson H. Sanderson, in the widely heralded navy mystery ship with the Wright 600 horsepower engine, had to land in a golf course when similar trouble developed on the fourth lap. He was averaging around 186 miles an hour.

Lieut. Stephen W. Callaway, also of the navy, piloting Booth Racer No. 2, had to take the ground at the beginning of the second lap because of a broken oil lead. He had made the first lap in 163 miles an hour.

Capt. St. Clair Street completed four laps in his Sperry high speed pursuit, powered with a 350 horsepower Wright motor, and then bugs developed and he had to land in a golf course a half mile back of the Grand Island. He brought his plane down safely. He was averaging 165 miles an hour.

Two Navy Craft Finish

The only ships that finished for the navy were the Curtiss racers, piloted by Lieut. Albert J. Williams Jr. and Lieut. Harold J. Brow. Each flew a good race. Brow in particular handled his ship at the pylons with a craftsmanship almost equal to that of Maughan.

Brow's time for the race was 193.2 miles an hour. Williams's time was 188. Brow's ship has wing radiation. Williams carried two Lamblin radiators, open mesh ovals that look something like wire waste baskets. The resistance of the Lamblin is said to have decreased Williams's speed by fifteen miles an hour.

Hangar gossip had had Maughan a winner weeks ago. Maitland is a skilled pilot. He is at home in any kind of a ship. But Maughan belongs to that rare species—a birdman to the manner born. There are few like him. Hunter is said to be his nearest approximation at Selfridge Field.

After the race had started and a line had been gained on the other entrants, particularly the freak machines of which so much had been

whispered, it was apparent that Maughan and Maitland would battle it out.

216-Mile Speed on One Lap

And at the end of the first lap, when the judges announced that Maitland had made the circuit at 216 miles an hour, the grand stand and press box were in a turmoil. They couldn't believe it. The judges, however, insisted that was his time.

In any event it changed the complexion of the race. Maughan's average for the first lap had been but 206. Then Maitland's average for the second lap was announced—200. Maughan crossed the timers' wires the second time, averaging another 206.

Maitland on his third lap slipped back to an average of 197 miles an hour. Maughan was timed at 207. It was apparent that an error had occurred in the computation of Maitland's first lap, or that he had unconsciously lost his way and skipped a pylon at either Gaulkers Point or the United States cruiser Dubuque. But no rectification was made.

Maughan's average for the fourth lap was 205 miles and for the fifth and final 206. Maitland averaged 203 for the fourth and 200 for the fifth.

Maughan was the first to land.

The Curtiss Marine Trophy Race

The Curtiss marine trophy race was flown October 8 under lowering skies and in a boisterous air. Eight naval seaplanes started in the 160-mile flight and two finished. The winner, piloted by Lieutenant A. W. Gorton, United States Navy, was the T R-1 ship-plane. It covered the course of eight twenty-mile laps with three landings at an average of 112.65 miles an hour.

The second ship to finish was the Standard Vought observation seaplane, driven by Lieutenant H. A. Elliot, who attained 109 miles an hour.

In the course of the race, six contestants were forced out, one because of engine failure, one from loss of radiator water, two from propeller trouble, one from exhaustion of gasoline and one from a broken wing tip pontoon.

Lieutenant Gorton, the winner, flew a perfect race. His water work was especially good, as he slid into the water controls at the end of the fifth, sixth and seventh laps without shock or "porpoising."

Gorton belongs to Pawtucket, R. I., is a war veteran and participated in the second battle of Verdun as a member of the Ambulance Corps of



The Thomas-Morse Army Racer



The Verville-Sperry R3 Army Racer, equipped with 400 H. P. Wright engine

the French army. He transferred from the French army in 1917 to naval aviation. He has had more than 1,200 hours in the air.

The T R-1, which carried off the honors of the day was designed by Commander J. C. Hunsaker, of the Bureau of Aeronautics, United States Navy, and built at the naval aircraft factory in Philadelphia. It is powered with a twenty-horsepower Lawrence Radial air-cooled engine, a new development in American engineering practice.

Liberty Engine Builder's Trophy

Lieutenant T. J. Koenig, in a Detroit-built plane, equipped with a Detroit-made motor, won the race for the Liberty engine builders' trophy October 13 over the 240-mile triangular course, with an average speed of 128.8 miles an hour.

The plane, a Lepere observation, was built by the Packard Motor Car Company, as was its engine, Liberty 12, 400 horsepower. It is the same plane in which Lieutenant C. J. MacReady established the world's altitude record of 37,000 feet last year.

Lieutenant Koenig varied not more than two miles an hour in any lap from his average speed for the ten laps. The first three laps he made at 130 miles an hour, the next five at 129 miles, the next five at 128 miles, and the last lap at 129 miles an hour. On the last leg of his last lap, while he was over Lake St. Clair, his air pressure feed, which forced gasoline to the carburetor from the tanks went wrong and he was compelled to resort to an emergency gas tank for fuel.

Second place in the race went to Major Follett Bradley in a De Haviland 4-B observation plane. He averaged 126.4 miles an hour for the ten laps. Major Bradley is a graduate of Annapolis.

Lieutenant W. L. Boyd, also piloting a De Haviland 4-B observation plane won third place. He flew a perfect race, averaging 122 miles an hour in every one of the ten laps. Army men said this was a remarkable achievement.

Only six of the nine starters in the race finished. Fourth place went to Lieutenant W. R. Carter, in a De Haviland 4-B observation plane, with an average speed of 118.1 miles an hour; fifth place, to Lieutenant J. D. Givens in another De Haviland, averaging 114.1 miles an hour, and sixth place, to Lieutenant B. R. Morton, also in a De Haviland, who averaged 112.8 miles an hour. Lieutenant Givens made the most spectacular race, his turns being hair-raising.

Detroit News Contest

Piloting a Martin transport, driven by two 400-horsepower Liberty motors, Lieutenant Eric H. Nelson of Montclair, N. J., won the Detroit News aerial mail trophy race for multi-motored planes October 12. He covered the 240-mile triangular

course at an average speed of 105.1 miles an hour.

The Detroit Aviation Country Club trophy race, flown over the same course, was won by Lieutenant Harold H. Harris, one of the two army entrants, in the "Honeymoon Express," equipped with a 400-horsepower Liberty 12 motor. Lieutenant Harris averaged 135 miles an hour in this event, which was for light commercial planes, finishing four laps ahead of C. S. Jones, in a Curtiss Oriole, who averaged 110 miles an hour.

A stiff northwest wind blowing at the tail of the big planes in The Detroit News event made necessary abandonment of the original plan of starting all of the craft together. Consequently the planes, each weighing five tons and having a wing spread of seventy feet, took the air one after the other, Lieutenant Nelson's plane being the last to cross the starting line. The transport began at once to overhaul the other racers, and before the race was three-fourths over it was seen that unless forced down, Lieutenant Nelson would win.

All but one plane of the nine entered in the two events finished. James M. Johnson, in a Vought V. L.-7, was forced down in the fourth lap when dirt fouled his carburetor. He landed near the Mount Clemens Golf Club and ran into a ditch, damaging his landing gear and both wings. Neither Johnson or his two passengers were injured.

Lieutenant Nelson, who, when he alighted from his plane at the finish, was warmly congratulated by Major Gen. Mason M. Patrick, Chief of the Army Air Service, carried three army privates during the flight. Both Lieutenant Nelson and Lieutenant Harris ascribed their victories to the "good planes" they piloted.



The 18T Curtiss Triplane, equipped with CD-12 Curtiss Engine, which won the prize for speed in Curtiss Marine Trophy Race

Lieutenant Nelson was one of the pilots in the army's New York-Alaska flying expedition in 1920. Lieutenant Harris is a McCook Field, Dayton, Ohio, pilot.

Twelve hundred dollars was awarded winners of the two races, in addition to the trophies. Prizes of \$600 and \$200 were awarded, respectively, to second and third places in both events.



Venville C. P. Racer, equipped with 600 H. P. Packard Engine

Across the Continent in Twenty-two Hours

Doolittle's Transcontinental DH4B Alterations—Other Transcontinental Flights

Lieut. Doolittle's Wonderful Feat

SEPTEMBER 5th, was a red letter day in the history of aviation in this country for it marked the successful culmination of a remarkable airplane flight across the United States from the Atlantic to the Pacific Coast within the elapsed time of 24 hours, the first time such a feat has ever been accomplished.

A young Army aviator, tired and exhausted from the strain of his long flight, his eyes heavy for lack of sleep, but happy in the thought that he had accomplished his cherished ambition, hopped out of his plane at Rockwell Field to greet his admiring comrades in the service who had gathered to meet him. This pilot, with a string of aviation achievements to his credit that belies his name, Lieutenant James H. Doolittle, broke all previous existing records for a flight across the continent, his actual flying time being 21 hours and 20 minutes, and his elapsed time 22 hours and 35 minutes, a stop of an hour and fifteen minutes being made at Kelly Field to replenish his fuel supply.

Following Aerial Age prints a detailed list of all the changes made in the DH4B used by Lieut. Doolittle in his record one-stop transcontinental flight. A new main gas tank of 240 gallons was installed immediately back of the engine, necessitating the moving back of the pilot's cockpit, changes in location of struts, control and brace wires and a number of others, including a lift wing on the axle.

a. The two vertical fuselage struts at station ten were moved back about 4" to a point directly over the spreader bar between the rear spars of the two lower wings and the fuselage brace wires in back of the engine were moved forward two and three-quarters inches at the top in order to accommodate the two hundred and forty gallon main gas tank. Normally the tank is of 88 gallon capacity. The controls and front pilot's cockpit were moved back sixteen inches for a similar reason and the aileron control was turned around so that the arc was in back of the pilot's seat. This was in order to allow the main gas tank to be as deep as possible and necessitated an extra set of pulleys in the aileron controls.

b. The cross brace wires under the tank were removed and 1-1/8" laminated wood braces put in, in front of and in back of main tank to take the strain. That left a 1-7/8 by 3 in. laminated wood brace between the landing gear fittings instead of the standard 1" by 3" spruce compression members.

c. The Year or observer's cockpit was boxed in with 3/16" 3-ply veneer adding great strength to this inherently weak part.

d. A 3/4 x 1-1/4" ash brace was placed under the top longerons for a distance of eight feet to prevent bowing and to add strength.

e. Six vertical compression members were added between station ten and the engine to transmit the weight of the gasoline tank from top longeron to bottom.

f. The tail skid post, axle and shock absorber bars were reinforced by having an extra seamless steel tube driven into them their entire length.

g. Old style DH-4A ash landing gear was used for strength and also because it is four inches higher and would so raise the lower wings into a more efficient position and give more clearance for the

h. A wing 17" x 48" was built on the landing gear fairing and set at an angle Martin propeller.

i. The tank cowl was raised 1-3/4 inches to allow for the higher gas tank and also to give a slight camber to the top of the

j. The main gravity full tank held thirty gallons and was placed between the spars in the center section. There was a 1-1/2 gallon expansion tank for water in the leading edge of the center section. The oil tank held 24 gallons and was placed under the motor and held in place by three straps running to the upper longerons.

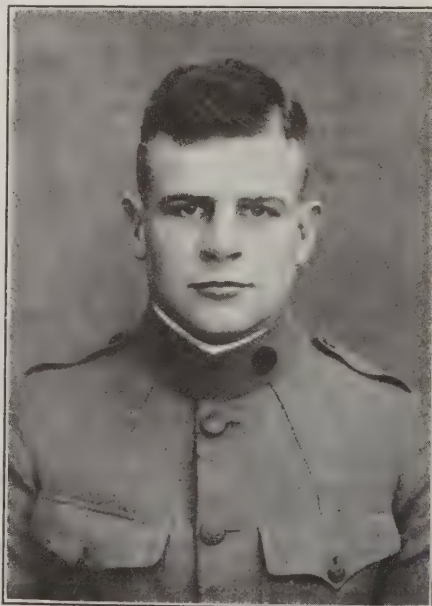
k. The syphon system of gasoline feed was used and found to be most satisfactory.

l. The main gas tank was notched out for a distance of nine inches to allow it to set down over the spreader bar between the front spars of the lower wings. A 1-3/4" hole in the tank allowed room for a rod to tie the longerons together.

m. The bottom of the fuselage was dropped and lowered so that it made a perfect streamline from radiator cowl to tail.

n. The wings were of selected spruce, care being exercised to pick out the lightest possible frames. The extra ribs in the inner bay were spliced and ran out to the trailing edge. An extra rib was placed in between each rib in the outer bay and the ailerons each had an extra rib between each regular rib. The fabric was sewed on with a 1-1/2" stitch instead of a 3" stitch. The wings were given four coats of dope, two of pigmented dope and one of varnish. All of this added about ten pounds to each wing but greatly strengthened them and the extra ribs allowed the wing panels to retain their original shape and this increased their efficiency.

o. The "ship" had an excellent performance. Took off in about three hundred and fifty yards full. Climbed seven thousand feet in fifteen minutes at 1550 R.P.M., and flew about 100 M.P.H. full and 105 M.P.H. nearly empty at 1480 R.P.M.



Lieut. James H. Doolittle

(Concluded on page 561)

How the Fastest Aeroplane in the World Was Built

THE victory of the Army-Curtiss racer, which flew faster than any machine has ever travelled before, is no more remarkable than the speed with which the aeroplane was built. The design had been submitted to the Navy Department as representing a year's improvement in the Curtiss-Navy racer which won the Pulitzer Trophy race of 1921. But the Navy seemed reluctant to order a plane built by the same company to compete against the fastest plane existing in the service.

Believing in the unparalleled efficiency of this design, private interests were sought to sponsor its entry in the race. The time for the race was drawing near and there seemed no chance of demonstrating its true worth. Then came a request from the Army for a pursuit design embodying just such features as possessed by this ship, bringing it to the favorable attention of Air Service officials. Arrangements were soon made for the construction of two test ships to fulfill the apparently daring predictions made for their performance.

A year's time is usually allowed for the building of any new type of aeroplane; this was an unusual design and under ordinary conditions the time would have been too short. But instead of extending the period of construction, a new condition arose which completely upset existing plans on time limits and customary routine procedure in the matter of aeroplane building—the Air Service wanted those two ships built in less than 90 days. Contracts previously let to other companies for racing planes called for delivery in time for the Pulitzer Trophy race, the speed classic of the year, which brings out the best speed possible in each of the ships entered. Could Curtiss build the ships in time to compete against the others?

Under ordinary conditions, the answer could be in the negative. It would be impossible. Government aeroplanes of various types were in production at the Curtiss Plant—large bombing planes were moving along through their various processes of production with clockwork regularity. No, it would never do to risk building up any part of the work already under way, and there was no part of the factory which could be set apart for the purpose. But the Government wanted those new ships at once, for the design showed a ship capable of outclassing the best of them and therefore *must* be built in time for the race.

A consultation by the officials, engineers and heads of departments brought to light several interesting points which gave a promising aspect to the situation. The employees in every department united to carry through the decision arrived at; the work could be done, for the men were willing to sacrifice themselves to do it. It was a real test of their skill and of loyalty to their government. The question was settled then and there that the Army could get the ships in time.

The workers volunteered to give up their recreation building where noonday and weekly dances were held. The building was quickly transformed overnight into a factory complete in itself—all the necessary wood-working and metal machinery was installed so that work on the racers could proceed with no effect on the other work in the main shops.

While the equipment was being put in readiness, other work was proceeding in the Engineering branch, where the design goes through some very essential processes before reaching the shop. In the Mathematical and Design Analysis Departments, calculations are made of the structure as a whole and of the important units which comprise the machine. Determinations are made of the proper materials to use and the sizes required for safety. In the Research Department, investigations are made of the theories and assumptions upon which the calculations are based, and tests made to verify the correctness of the design by means of "wind-tunnel" experiments.

An important feature of the wind-tunnel work is the testing of accurate models, made in the Model Shop. These models are exact miniature reproductions of the aeroplanes to be tested. So necessary is accuracy in these models, that in true scale they do not depart from the figured dimensions more than 1-4000 of an inch. The slightest inaccuracy in constructing them would render the tests worthless. In the wind-tunnel, the model is suspended in an artificial air stream which simulates the conditions existing in flight. By means of indicators and scales, it is possible to determine immediately the performance and degree of stability which can be expected in the finished aeroplane. In this connection, it is interesting to note that wind-tunnel tests showed the Curtiss-Army racer to be capable of a speed of 219.8 miles an hour, whereas on its first flight, the official timing of its actual speed showed it to be 219.5 miles; this varies less than one-quarter of 1 per cent. from the predicted performance for speed. The balance of the finished machine checked up perfectly with the preliminary recommendations of the Research Department.

Materials were tested in the chemical laboratory, where formulas for special steels and compositions are originated. Careful tests are made of many materials entering into the construction of the aeroplane so they may be selected to give the best possible service.

In the Physical Laboratory, wing ribs and tail units, etc., of the proposed design were built up and loaded with weights to represent the stress imposed during flight. Determination is made of the breaking point of each part so that weak places can be strengthened and parts proving too strong for the work required of them can be lightened. In this way, before the actual machine is built, there is no question about uniform strength throughout, no uncertainty about the reliability of the materials used and no doubt about its performance.

As parts were tested and found satisfactory, drawings for their construction were released to the shop. Shop foreman and many of the men skilled at special jobs were at work in stretches of from twelve to sixteen hours daily.

The wing radiators were a problem at first. Radiators of this principle had proven their worth in other Curtiss aeroplanes tested in the months preceding their adoption for the racing design. But complete wings such as these had never been

built before, and the fact that they proved successful in a high-speed racer reflects great credit to the engineers responsible for them and the men whose patient work made it possible to complete them without mishap. The wing-radiator was adopted only after considerable research work was carried out to ascertain its advantages over the conventional forms of radiators. The idea was patented by the Curtiss Company some years ago and might have been used in connection with the Gordon Bennett Racer of 1920, but having no absolute data on their value, it was considered best to experiment with them until they became perfected before depending upon them for racing purposes.

Wing radiators of different forms and materials were applied to some of the Curtiss "Oriole" aeroplanes, where their efficiency was soon established. An Oriole plane with such a radiator was flown from New York to Kansas City, Missouri, a distance of about 1500 miles, at a speed averaging 100 miles an hour.

For many years it has been the aim of aeronautic engineers to reduce the head-resistance of radiators, and to do away with this resistance entirely is an advancement worthy of note. With wing radiators, the usual resistance of ordinary radiators is eliminated, which in turn adds to the speed of the aeroplane. In place of the automobile type of radiator, the engine water is cooled by circulating through narrow cells formed by corrugations of thin sheet brass with which the wings are covered. The surface friction of the air flowing past the wings must exist anyway and the wing radiator puts this air contact to good purpose. It has been established that this form of radiator has added not less than 12 miles an hour to the speed of the Racer. As to their reliability of functioning, after the first trial flights the pilot found nothing that required altering and further flight tests were continued with no adjustment necessary to any part of the system.

In connection with the water cooling system an original oil temperature regulating system is provided. It is well known that water heats up quickly as it circulates through the engine; also, the lubricating oil is slow to heat up, being so heavy. An ingenious method of locating an oil radiator in the water cooling system insures not only that the oil will be warmed up quickly, but also that its temperature will be kept uniform once it reaches the same temperature as the water in the radiator.

It is not possible to attribute the success of the Army Curtiss racer to any feature of its construction, for so many improvements exist throughout the design. A good share of its success, however, is due to the men in the various departments of the Curtiss plant—Executive, Engineering, Mathematical, Research, Chemical and Physical Laboratories, Designing, Drafting, Experimental, Model, Wood-working, Metal Working, Welding, Radiator, Sheet Metal, Covering, Doping and Painting, Heat Treating, Sand-blasting, Plating, Wire, Propeller Department, the Motor Factory, and Motor Testing Laboratory, Machine Shop, Inspection Department, all combined in one purpose—to build the fastest aeroplane in the world.

1921 Curtiss-Navy Racer Speed Increased 16 Miles

THE Curtiss-Navy racer in the Pulitzer Trophy Race of last year, proved to be the fastest plane entered. Its winning speed was 177 miles an hour.

The Navy Department, wishing to enter this machine again in the 1922 race, gave the Curtiss company the opportunity of improving it in an effort to increase its speed. A year's progress in aeronautics made it possible to incorporate changes which reduced resistance and increased the lift to such an extent that a gain of 15 miles an hour was made in its speed. In an entirely new ship the increase would not have been so remarkable, but in this case the plane used in the experiment is the identical ship which won the race last year.

At slow speed, the resistance of an aeroplane is correspondingly low and irregularities in outline as well as blunt surfaces presented to the air are not of great moment. But as speed increases, resistance increases not in direct proportion but in a ratio of the "square of the speed"; in other words, if a wire, strut or other portion of an aeroplane has a resistance to the air of, say, five pounds when the machine travels at 100 miles an hour, at 200 miles an hour the resistance would not be ten pounds, as might seem natural, but would be four times that force, or twenty pounds.

At high speed, the retarding force of the air becomes the factor which limits the maximum velocity obtainable in an aeroplane.

The two French "Lamblin" radiators used before were the most efficient known, as their resistance to the air was the lowest by comparison with existing forms of radiators of the required capacity.

Even so, their resistance at 180 miles an hour was about 50 pounds. By replacing the Lamblins with wing radiators, this resistance was entirely eliminated and still adequate cooling was retained.

In the wing-radiator, the water for cooling the engine circulates between double sheets of corrugated brass which cover the wing surfaces. The metal wing surface therefore dissipates the heat of the water by transferring it to the air, and thus the water is cooled without any additional apparatus exposed to the air. Before adopting this radiation principle, it was tested in all kinds of flight conditions during a period covering several months. During this time, sample radiators were installed on some of the Curtiss commercial planes, and cross-country flights, one of over 1500 miles, were made without mishap. Improvements brought about by the experience gained from actual use made possible their adoption for the racer with certainty about their efficiency.

A new wing-contour was adopted. This is the C-27, having less resistance and a higher lift at high speed than any wing ever tested. This shape was evolved in the Curtiss aerodynamic laboratory.

Streamline caps were fitted around all bolt heads and fittings, which project into the air stream. Corners and angles formed by the intersections of surfaces were filled and rounded out with Balsa, the lightest wood existing. Wire terminals were encased in smooth shells which tremendously reduced their resistance.

An original idea was carried out for covering the spaces between fixed and movable tail surfaces; that is, between fin and rudder and between stabilizer and elevators. Strips of sheet rubber were

spread across the openings, attached to the edges with linen tape, leaving the surface perfectly smooth at all times, thus not restricting the proper movements of control.

A most important change has been made in the contour of the wheels. The most up-to-date method of streamlining a wheel has been to cover the sides with linen. Curtiss Engineers set about to improve on this with the result that a saving of 37 per cent. of the wheel resistance was effected. The result was accomplished only after extensive calculations and tests had been made. Several wheels of varying side contour were tested in the Curtiss wind-tunnel, where their relative merits were determined by scale balances showing the resistance of each. It was found that a wheel with a full elliptical section was the best through the air with the greatest saving of power. Building out the sides of the wheel to the determined contour was easily accomplished with sheet aluminum discs, covering the whole unit, discs are tires with linen, doped and varnished. The use of these wheels gave the machine an increase in speed of 1.3 miles an hour equal to a total saving of 10 horsepower for both wheels at high speed. Streamlined cast aluminum hub caps and streamlined tailskid completed the landing gear improvements.

Trivial as some of the changes appear and in spite of the extra weight their incorporation necessitated, the additional speed and efficiency obtained indicates the advancement being made by practical engineers of the largest pioneer aeronautical organization constantly engaged on improving the best existing aeroplanes, and employing the most modern testing equipment and methods.

Lighthouse Developed for Night Flying

IN preparation for the night flying which will soon be undertaken by governmental and civilian aviation interests, the Aeronautical Chamber of Commerce announces the development of two types of aerial lighthouses to mark and illumine the way from New York to San Francisco. One of these devices, a beacon, is already in operation at Hampton Roads under the supervision of the Navy Bureau of Aeronautics; another a ground wind indicator, is being installed by the Army Air Service at Dayton, Ohio; while the Post Office Department, as was indicated recently by Colonel Paul Henderson, Second Assistant Postmaster General, is negotiating for equipment to be installed either between New York and Chicago or Chicago and Cheyenne.

The development of these lights is another indication that the United States is not lagging in aviation. At Elizabeth, N. J. is located the plant of the American Gas Accumulator Company, the United States unit of an international corporation. Immediately after the Armistice, the British Air Ministry requested the English unit of this corporation to work on the illuminating problems of night flying with the result that lighthouses were established for the London-Paris route, first at Croyden, near London, and later in Kent. The American unit, which had specialized in marine and lighting signalling devices, be-

gan where the British unit left off and is now carrying on experimentation which promises significant development in the near future.

"The problems of night flying," according to E. R. Boots, General Manager of the American Gas Accumulator Company, "resolves itself mainly into a question of setting signals to keep the pilot on his route and so illuminating emergency fields and terminals that he can land safely into the wind. With the present encouraging application of radio and utilization of the compass in aerial navigation, the ground light is of primary importance. We consequently have developed what is known as the *Aga* Automatic Ground Wind Indicator. This apparatus has been designed to fulfill the purpose its name implies, and it is intended to act as a signal to aviators both by day and night. It is intended for use upon emergency and other landing grounds where no personnel is available. The whole unit is entirely automatic in operation and when installed in its permanent position it will be equipped to operate without human attention of any kind for periods of six months to one year. It is in the form of the letter T, and very nearly approximates the style internationally agreed upon to indicate landing zones. The three vanes are mounted in such a manner as to receive upon their upper surfaces light projected

through the dioptric lenses fitted round the light source, and these lenses together with the vanes are free to rotate about a vertical axis. By the employment of a suitably designed rudder the head of the unit is equipped with the Gas Accumulator wind. It stands five feet high.

"The light power projected upon each of the vanes is 27,000 E. S. candlepower. It can be seen as a day signal at a range of about 5 miles when observed from normal flying heights. As a flashing light without definite shape, it can, at night, be seen from about 12 miles, and its shape and bearing can be clearly established from a distance of two to three miles. The unit is equipped with the Gas Accumulator Company's Sunvalve and gear for automatically changing mantles.

"The sunvalve is an interesting feature. It is worked by the action of solar radiation and is so designed as to be operative under any temperature changes. Briefly the system employed is that a central black body is surrounded by highly polished pillars; light, and therefore heat, falling upon these elements, is absorbed by the black center and reflected by the outer gilt columns. Consequently the black portion expands under a given influence, to a greater extent than the polished elements; this difference in expansion is utilized to open and close a gas valve

ing the light off and on according to prevailing degree of light and darkness. A valve of this type brought the Croyden light into action during the last eclipse of the sun.

It is a light of this type that we are installing at Dayton, for the Army. It has been our recommendation for both the Army, along the Model Airway, and the Post Office Department, on the Chicago-Cleveland Route, that they survey the route to determine suitable emergency landing fields, which shall be located not more than twenty miles apart, and that one of these automatic Ground Wind Indicators be installed to mark each of these fields, so that a flier can hop from one to the other, and in case of a forced landing, always be able to glide to the field ahead of him or the field over which he has just passed. He will be able to determine the direction of the ground wind

when he gets within three miles of the field, and by having these lights located in the same position in each field, the flier will be able to determine his landing space from the location of the light.

"As the ground lights will not be visible for great distances, it will be necessary, just as with marine transport, to provide great beacons for the airways. The *Aga* Beacon has a light range of over 35 miles.

It is a small unit of this general type twelve months without attention. It is of the revolving type, the rotation of the lenses being obtained by the movement of certain sensitive diaphragms which are operated by the gas passing under pressure to the burner; on the light being extinguished by a sunvalve the optic ceases to rotate.

It is a small unit of this general type which is now being tested by the Navy at Hampton Roads.

"Our aeronautical engineers recommend that one of these large revolving aeronautical lights of very great candlepower be located at convenient points along the route that is to be flown by night at distances of forty or fifty miles apart. These lights are to be located on promontories where they will have the maximum range of visibility, and will have a code flash so that each one may be identified by the flier. Their value will be to lead fliers back to the airway in case they stray from it on account of fog or storm. These lights also have the advantage of giving the aviator definite information regarding his location when he has returned to the route, or when there is a question of his position after flying above clouds or through fog. These lights are similar to the ones which are giving the British Air Service so much satisfaction on the London-Paris Route."

Simple Formula for Estimating Aeroplane Ceilings

By Walter S. Diehl

Summary

THE absolute ceiling of an average aeroplane is given to a close approximation by

$$10000$$

$$H = 19000 \log_{10} \left(\frac{W}{HP} \right)^2 \left(\frac{W}{S} \right)$$

H = absolute ceiling, in feet

$\left(\frac{W}{HP} \right)$ = "power loading," based on full load and normal B.H.P.

$\left(\frac{W}{S} \right)$ = wing loading, based on full load.

The aeronautical engineer often has occasion to estimate the absolute ceiling of an aeroplane for which a detailed performance calculation is out of the question. In such cases it is customary to use either empirical performance charts or formulae. The performance charts which are given in several of the recent works on aerodynamics and performance are satisfactory so long as the aeroplane under consideration does not depart too far from the average in its characteristics. The formulae, with one exception, are no better. The exception is developed by Kann in Technische Berichte 1-6 and is of the form

$$H = C_1 \log_{10} C \frac{C_L^{\frac{3}{2}}}{C_D^2} \pi^2 \left(\frac{W}{HP} \right)^2 \left(\frac{W}{S} \right) \quad (1)$$

H = absolute ceiling

C = propeller efficiency

$\left(\frac{W}{HP} \right)$ = power loading $\left(\frac{\text{gross load}}{\text{normal BHP}} \right)$

$\left(\frac{W}{S} \right)$ = wing loading $\left(\frac{\text{gross load}}{\text{wing area}} \right)$

C_L = absolute lift coefficient

C_D = absolute drag coefficient

C₁ & C₂ = constants.

The chief criticism of this formula is that it is too complicated for extensive use.

Experience has shown that the terms $\left(\frac{C_L^3}{C_D^2} \right)$ and π^2 may be neglected without seriously affecting the results given by the formula. That is, we may write

$$H = K_1 \log_{10} \frac{K_2}{\left(\frac{W}{HP} \right)^2 \left(\frac{W}{S} \right)} \quad (2)$$

and determine appropriate values of the constants K₁ and K₂ by calculation or from reliable performance data. Obviously K may be arbitrarily assigned any value which will cause the term within the brackets to assume a reasonable value.

K has been determined for a number of The average value of $\left(\frac{W}{HP} \right)^2 \left(\frac{W}{S} \right)$

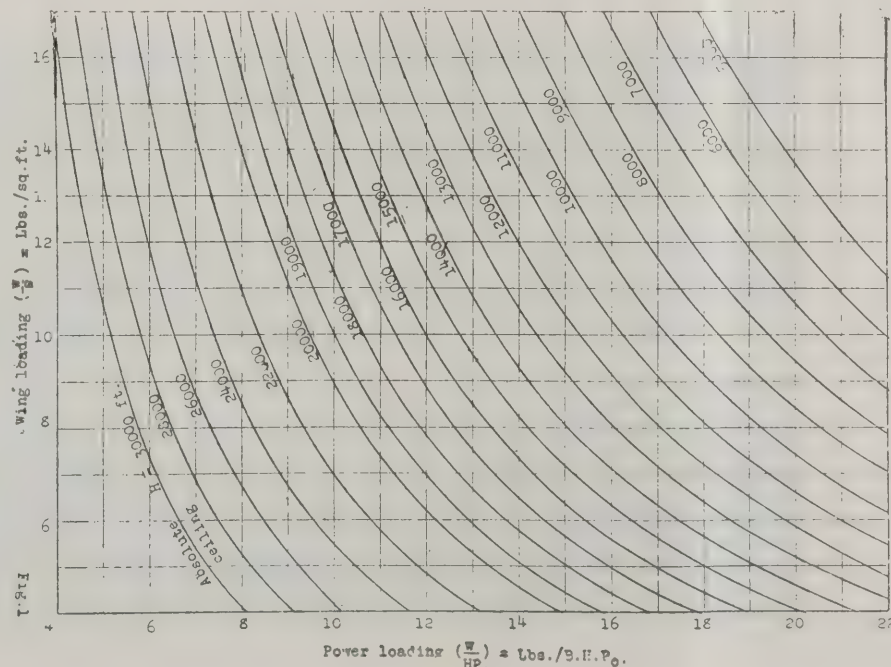
is of the order of 1000 and it is desirable that the log term be about unity.

K₂ = 10000 (3) fulfils this requirement and the formula may be written:

$$H = K \log_{10} \frac{10000}{\left(\frac{W}{HP} \right)^2 \left(\frac{W}{S} \right)} \quad (2a)$$

aeroplanes of all types and is found to have an average value of 19000 with individual values ranging from 17500 to 21000. In most cases, however, the value is quite close to 19000 as shown by Table 1, which contains a few representative determinations of K.

(Concluded on page 571)



Torpedo Planes Hit Atlantic Fleet

ON the morning of Wednesday September 28, 1922, the three battleships, the *Wyoming*, *Arkansas* and *North Dakota*, were approximately fifty miles off the Virginia capes, in company with a squadron of destroyers to the number of approximately thirty, airplane torpedo and bombing squadron No. 1 of twenty 'planes the C7 Navy airships, and a number of pursuit craft, for the first maneuver ever held in which torpedo-carrying airplanes operated against ships. Eighteen of the twenty 'planes carried torpedoes while the other two carried the commanding officers of the squadron.

Preparations had been made for the scouting 'planes of the Atlantic Fleet, twelve in number, to accompany the torpedo planes in their flight through the capes from the Naval Air Station at Hampton Roads to sea in the attack against the battleships. The C7 airship from the Hampton Roads Station also took part in the maneuvers. In addition, there were naval planes from Washington carrying officials from the Navy's Bureau of Aeronautics for observation purposes.

About 9.30 in the morning, the torpedo 'planes left the beach and proceeded to sea in formation. When the first 'planes were sighted by the ships, the fleet was headed about due East, and rapidly overhauled by the attacking 'planes. The first attack was made at 10.18 a. m. The battleships were maneuvering at high speed to keep the 'planes astern but the squadron of aircraft divided and attacked from both flanks. The

Arkansas, the target ship and the one on which the Press and officials were carried, sustained seven hits out of 17 shots fired, all close aboard. *that did not hit ran* close aboard. The eighteenth torpedo was not discharged, and was carried back to the base.

The 'planes flew to within about a thousand yards of the ship, dove from an altitude of about 500 feet to within a few feet of the surface of the water, dropped their loads and then zoomed up and away to avoid theoretical raking fire from the decks of the ships.

The dreadnaught depended only on the skill of their navigating officers and their rudders in their efforts to avoid theoretical destruction by the torpedoes launched by the attacking squadron.

The fleet was supposed to be approximately due east of Cape Henry, at a distance of about fifty miles, the definite location being determined by observation of the airship C7 hovering over the fleet and the smoke which was discernible for twenty miles.

The scouting 'planes went out principally to render assistance to the torpedo 'planes should they chance to get into difficulties and to aid in the recovery of the torpedoes after they had been fired. All torpedoes that were fired worked perfectly.

Radio or other signals between aircraft or between the ships and the aircraft were not used in the trial. The 'planes used are known as the PT type, 2-seater, and are old as to type.

The characteristics of the PT (two-seater torpedo plane) are follows:

Power plt.—Libty. 400 h.p.	
Weight empty	4475
Useful load	
Crew, 2.....	360 lbs.
Gasoline.....	483 lbs.
Equipment. . .	30 lbs.
Ordnance....	1707 lbs.
	2580

Total weight	7055
Per cent Useful Load	36.5; lbs.,
ft. 8.8; lbs./h.p. 17.6; 112 gal. g	
10 gals. oil; endurance full load	
hrs; cruising endurance 3 hrs; w	
curve RAF 6; chord 6' 3"; gap	
7½" in front, 7' 5" rear; height	
7½"; stagger O; dihedral 2 de	
backsweep O; angle incidence, up	
5½ deg., lower 4 deg.; float tr	
13'2 3/16"; armament torpedo	
1. Lewis.	

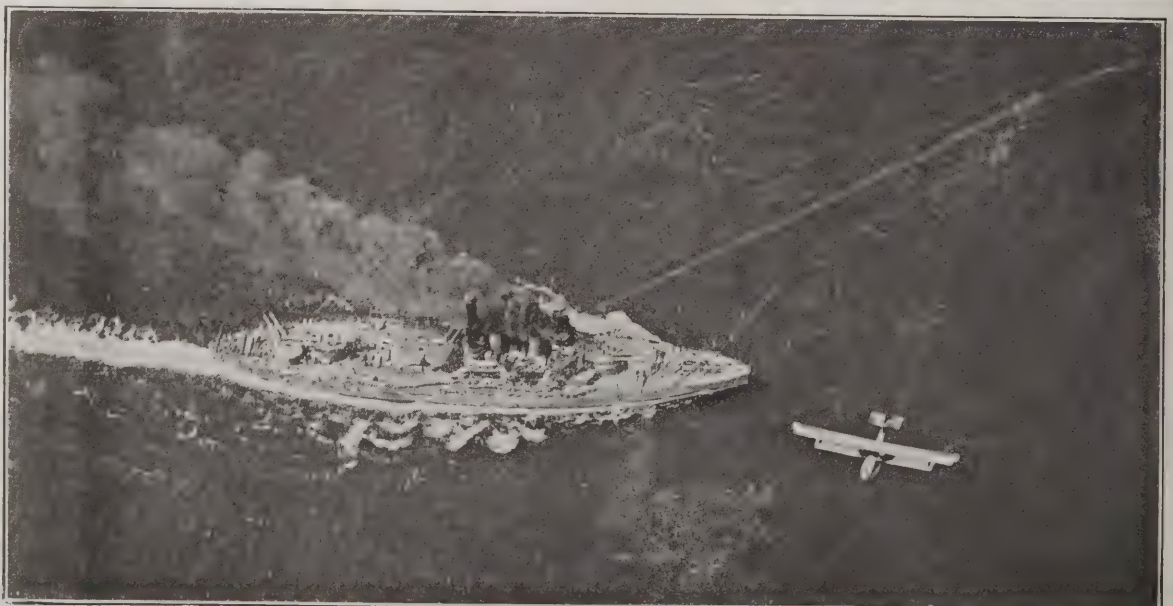
Surface areas as follows: wing inc. ailerons 808.5 sq. ft.; aileron 105.4 sq. ft.; stabilizers 54.8 sq. ft.; elevators 45.6 sq. ft.; fin 13.2 sq. ft.; non-skids 17 sq. ft.; rudded 23.8 sq. ft.

Performance: 85 m.p.h., climb 2000 ft. in 11 mins., and to 3000 ft. in 19 mins.

This plane was designed and built in the Naval Aircraft Factory, Philadelphia.

The PT1 is similar save that it is a 1-seater and the weight empty and the useful load is slightly less.

The Navy Bureau of Aeronautics has been working along consistent lines for the past year in the development of suitable torpedo planes for speed, maneuverability and distance. This work was carried out in recent tests at Anacostia air station of d



Showing the wake of a torpedo dropped from a plane in the recent naval maneuvers. A hit was registered

rent types, the Blackburn "Swift", the Fokker and the American-designed Davis-Douglas, which proved superiority and has been placed in production. These planes will be in the fleet early in the coming year.

650 H. P. Torpedo Craft

There is still further development work going on looking to the 1923 building program in which a new engine of 650 horsepower is to be incorporated in a new torpedo scouting and bombing 'plane. This engine is making its first appearance in the Pulitzer race in the "NW" or Navy-Wright 'plane, which has been especially constructed around this engine. The Pulitzer race is being taken advantage of for test. This engine expresses the highest development in power/weight ratio that has yet been achieved in aircraft so far as is known to the experts in the Bureau of Aeronautics. In order to place this 'plane and engine in the race and select a test under such severe condi-

tions, the manufacturers have been working at top speed to rush this 'plane through, to the end that they have shipped the machine to Detroit where it will be assembled and flown.

An entirely new torpedo scouting and bombing plane will be built around this engine if results are as expected for the future service work.

The racing 'plane has a spread of 30 ft. 6 ins. for the top wing, 17 feet for the lower, and incorporates all the features known in streamlining. The wheels are streamlined and enclosed in "pantaloons" and all wires are streamlined.

In a despatch to the Commander in Chief of the Atlantic Fleet the Secretary of the Navy speaking for the Navy Department expressed appreciation of the excellent results that were obtained from the torpedo plane practice held off the Virginia Capes.

Secretary Denby in his message to the Admiral emphasized the fact that the successful maneuvers conducted with torpedo planes and bat-

tleships was a high tribute to the efficiency of the Fleet organization and showed that Naval Aviation was being developed along sound constructive lines as strong and aggressive arm of the Fleet.

The Secretary's despatch read:

"Reports from the Commander-in-Chief and returning observers indicate that the torpedo plane practice completed off the Capes was well executed and that the maneuvers both by the planes in attacking and the battleships in avoiding attack demonstrated a high state of efficiency. The one hundred per cent performance of the torpedoes was most gratifying and creditable. The participation of forty planes and one dirigible and their prompt return to their bases after maneuvers seventy miles off the coast indicates the excellent condition of these forces. The Department is well pleased with the results of this practice and the advancement in the tactical use of the fleet torpedo planes that it demonstrated.

Report of International Conference on Standardized Airship Fittings and Operation

THE report of the international conference held at Australia House, London, February 14 to 17, 1922, to consider the question of standardizing certain airship fittings and operation, has just been made.

This conference was attended by the following: *British Empire*—A. H. Ashbolt, Agent General for Tasmania, Tasmania, R. A. F., Chairman, and Major St. A. F. C., *France*—Captain Sable, Air Attache, and Lieut. de Vaisseau Joughla; *Germany*—Major Stelling, of Parsel Airship Co., and Commander Herrera, of the Zeppelin interests; *Italy*—Major Graziani, Air Attache; *Russia*—M. Akasheff; *Spain*—Commander Herrera, managing director of the Spanish Argentine Co.; *U. S. A.*—Major H. C. Gager, U. S. Army, Commander Dyer of the Navy, and Mr. E. Wellington Butt, representing commercial interests; *Hon. Sec.*—Commander F. L. M. Boothby.

In addition to the countries represented by delegates, Japan, Switzerland and Czechoslovakia intimated their acceptance of the principle and asked for copies of the report.

It is called to the attention that the meeting was a strictly private one of experts of different nationalities to consider and discuss matters of common interest in airship communications.

It was the unanimous opinion of the conference that the following resolutions should be accepted by the nationalities concerned and that all airships and air-

ship stations built for international purposes should make provision for these recommendations:

1. "The principle of standardization is accepted.
2. "Standardization means such an arrangement as permits the airships of one nation to use the landing, mooring, gassing and refueling arrangements of any other nation.
3. "Each country retains for itself the right to receive airships by either or all of the following methods:
 - At air sheds
 - By mooring on the ground
 - On water
 - By 3-wire mooring arrangements
 - By mooring masts.
4. "When airships are landing at shed, on the ground, or on the water, that all trail ropes, pulley blocks used in connection therewith and handling guys be standardized.
5. "Any country adopting the principle of mooring to masts, shall provide that such masts and ships be provided with standardized couplings, water, petrol and gas connections.
6. "This Committee recommends to the next international air conference the formation of a committee to determine the airworthiness of airships. It is recognized that the conditions of airship travel vary according to route and season of the year, consequently the impossibility of laying down a definite margin of fuel and

ballast to be carried. The situation can best be met by a formation of a small permanent committee to determine margins for each route according to its merits.

7. "Each country be asked to create an official register of airships in which will be listed all airships and air stations indicating such airships and air stations as comply with the 'international standards' hereinafter arranged.
8. "Pending the decision of the Commission Internationale de Navigation Aérienne, it is resolved that the Council of the Aeronautical Society of London be asked to permit their secretary to receive correspondence referring to 'international standards' and, if desirable, to authorize him to convene a further conference. In such event, invitations will be forwarded to the countries interested through the air attaches of the embassies in London.
9. "Lloyds and insurance companies in different countries be informed of the resolutions and standards adopted by the Conference with a suggestion that such standards be adopted by Lloyds and insurance companies as the basis upon which minimum rates of insurance will be fixed.

Standards

10. "The metric system of measurement be adopted.

11. "All rigid, semi-rigid and non-rigid airships over 15,000 cubic meters capacity be required to carry:

a—A trail rope of not less than half the length of the ship with a minimum of 100 meters.

b—The forward side guy ropes to be such a length as to reach not less than 40 meters below the lowest point of the airship.

c—Eyes to which other guy ropes can be secured.

d—Some method of hauling down the stern.

12. "Air stations are required to provide:

a—A landing block capable of taking the largest trail ropes carried by an airship.

b—Side guys and toggles suitable for airships of any size.

13. "All gas, fuel, water and oil coupling pipes shall be fitted with 'international' right handed threads.

14. "In addition to facilities provided in sheds for refueling airships similar facilities should also be available on the landing grounds.

15. "This Conference recommends the following sizes as most suitable for the flexible connection between airships and mooring masts or air stations.

Gas connections, inside measurement—300 millimeters

Water connection, inside measurement— 75 millimeters

Fuel connection, inside measurement— 40 millimeters

Airships containing pipes of dimensions other than those indicated to have such arrangements installed as will enable

their pipes to connect up with the standards recommended herein.

16. "Air stations are to be fitted with female connections, airships with male connections.

17. "Airships designed for mooring to mast must carry a cone gimballed on to the ship and rotating on its own axis. The size and shape of such cone to be that shown on the attached drawing. The wires passing through such cone shall not exceed a diameter of 18 mm. Such landing wire must be fitted at the outboard end with a splice, the eye of which shall be 230 mm. long, also as shown on attached drawing.

18. "The mooring mast station must provide similar rope fitted with a quick coupling to take a loop at the outboard end of the trailing rope. The mast must be fitted to take the rope (up to 18 mm. diam.) together with the necessary coupling.

19. "Suggested signals for mast mooring.

At stations

At Day

At Night and in Fog

The position of the mast mooring wire will be indicated by

A White Patch

A White Light Waved

When the mooring wire ropes have been secured, the ground will signal the airship by

Waving a White Flag

A White Light Flashed

When the airship is ready to haul down the ship will indicate by

A Green Flag

A Green Light

To stop hauling the ship will indicate by

A Red Flag

A Red Light

To ease away the ship will indicate Red and Green Flags shown together Red and Green lights shown together

20. "The standards arrived at are in force for two years when the question can be considered in the light of further experience then gained. If at any time, any important development occurs or fresh inventions if by practical experience standards adopted are found dangerous, the Committee will immediately be convened to establish fresh standards.
21. "A hearty vote of thanks be paid to Sir Joseph Cook, the High Commissioner for Australia, in gratitude for the use of the rooms for the conference."

It is unfortunate that there exists in the United States and in Germany, and to a lesser degree, in England and France, no national agency empowered to put in force any such regulations as these, other than that may be no matter how advantageous for the advancement of navigation.

For the present, it seems, that there must be maintained by the Army and Navy of respective countries lists of airships and airship stations, with data thereon, the information of other countries' agreements arrived at unofficially.

In the matter of mooring masts, the subject is still exceedingly young and many varied are the designs extant. It has been possible, it will be noted, to confine the strictions as to these to but a minimum of items.

Curtiss Model D-12 Aeronautical Engine

THE Curtiss model D-12 engine is a development from the Curtiss model CD-12 engine of the same bore and stroke. After exhaustive tests on the model CD-12 it was decided to entirely rebuild the engine to decrease the weight if possible, increase the reliability if possible and improve the present fine accessibility. The seven-bearing crankshaft was retained as well as the well known use of main bearing caps on the crank-case. The distribution of the bearing areas on the main journals was changed to conform with Air Service requirements. This change necessitated the making of entirely new patterns and forging dies for all the main parts of the engine. A careful study was made of each individual part on the engine during this redesigning in order to

save weight as well as increase the strength if possible. The details of changes in the various parts of the engine are outlined below. The result of this redesign was an engine weighing 35 pounds less than the model CD-12 developing 10 to 15 horse power more at the same speed.

The Curtiss D-12 engine of the 60 degree Vee type consists of two rows of six cylinders en bloc having a bore of four and one half inches and a stroke of six inches with a total displacement of 1145 cubic inches. The engine is of the aluminum cylinder type with inserted steel sleeves in contact directly with the cooling water. The engine uses two overhead camshafts per cylinder head driven through bevel gearing and operating four valves per cylinder.

Cylinder Head Construction

The same cylinder head construction as used in the CD-12 engine has been retained. Steel cylinder sleeves of carbon steel hydraulically formed with one end closed are rough machined, heat-treated and then finished machined before assembly in the cylinder head with the exception of the final grinding of the bore. The threaded portion of the sleeve is approximately one and one half inches long at the upper end. Careful machining is done on these sleeves and the cylinder head to maintain a perfect joint between the aluminum head and the steel sleeve. An integral stud on the end of the cylinder head of the sleeve passes through the water jacket thereby improving the contact between the steel head

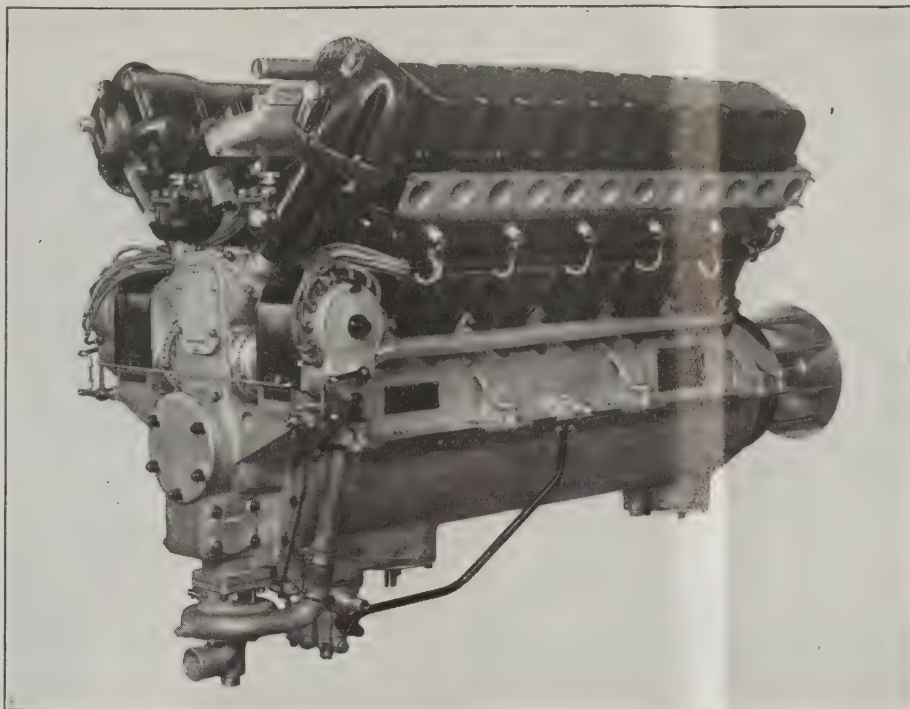
the aluminum head. The valve port holes are machined after the sleeve is assembled. Spark plug bushings are also assembled after the sleeve is in place, duralumin bushings being used in place of brass as was former practice. The aluminum water jacket which is cast in one piece for six cylinders is assembled over the lower end of the six sleeves, the water joint being maintained between the sleeve and jacket by a composition gasket under the flange on the sleeve. The upper joint is made tight with a copper asbestos gasket. The sleeves fit very snugly in the water jacket at the lower end which gives them ample support to prevent the main sleeve from going out of round.

Reduction in valve size of .040 inches was found necessary to make the valves removable from the cylinder without removing the valve guides. This slight decrease in valve size had no effect on the power since the power is actually higher in this new engine than in the CD-12 engine.

Valve Mechanism.

Each cylinder is fitted with four tulip valves, two intake and two exhaust which are interchangeable. These valves seat directly in the cylinder head as in former practice. The camshafts are mounted on the top of the cylinder heads on six aluminum brackets, the shafts running directly in the aluminum. These brackets are carefully dowelled to the head and are interchangeable, no alignment, reaming or hand scraping being necessary during manufacture or overhaul. The intake camshaft is driven by the exhaust shaft through gears at the anti-propeller end. A bevel gear is mounted on the exhaust camshaft in a novel way. The pin gear on the exhaust shaft is extended beyond the width of the normal gear and the bevel gear is externally splined with a Fellows gear shaper to fit over this extension. A single large flanged nut holds this gear on the shaft. Owing to the fact that the number of teeth on the spur gear differs from the number of teeth in the bevel gear a very fine adjustment is obtainable on the timing by shifting the gear in relation to the shaft.

One cam operates two valves through a Tee shaped tappet working in a bushed hole in the cylinder head. This tappet has been redesigned to increase its strength, reduce wear and facilitate production. This type of tappet removes all side thrust from the valve stems. The valves are adjusted as before by adjusting screws



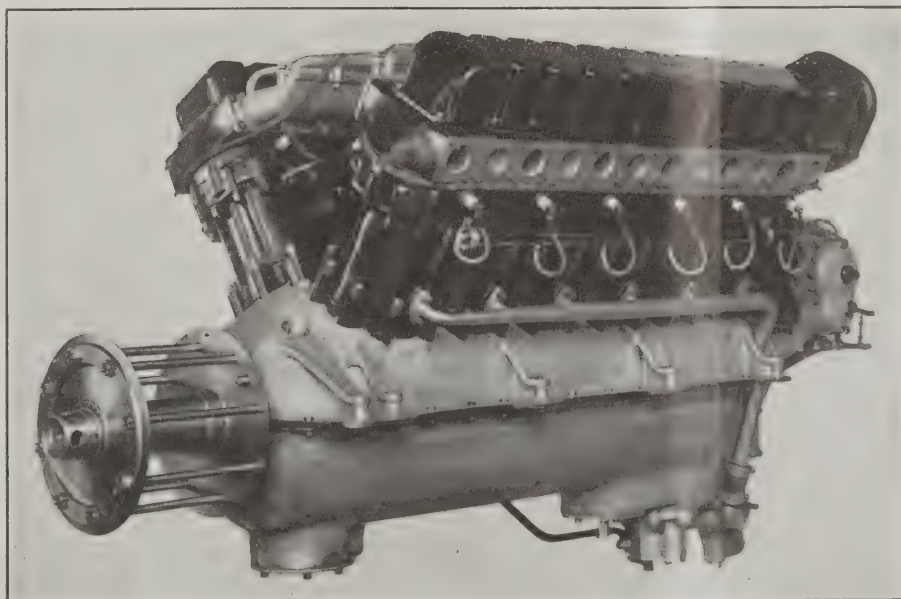
Magneto end view of the Curtiss CD-12 Aero Engine

clamped in the ends of the Tee tappet. The camshaft bearings are lubricated by oil pressure of approximately 10 pounds per square inch and the Tee tappets and valve guides are oiled by splash.

Crankshafts

The crankshaft is one of the conventional seven-bearing type being made of low chrome nickel steel. The crankshaft has been redesigned to take care of the redistribution of the main bearings, the center bearing being $1\frac{3}{4}$ inches effective length and the balance of the bearing $1\frac{1}{2}$ inches thereby doing away with the

three 1" bearings used in the CD-12 engine making larger bearing surfaces and decreasing manufacturing costs. The same journals and crank pin sizes of 3 inches and $2\frac{1}{2}$ inches respectively have been retained. The crank cheeks have been made oval instead of rectangular increasing the width $\frac{1}{4}$ inch and decreasing the weight of the crankshaft at same time giving a stronger and lighter shaft. The same type of propeller thrust bearing is used on this engine mounted between No. 7 and 8 main bearings, namely, a deep-grooved radial annular ball bearing. This



Propeller end view of the Curtiss CD-12 Aero Engine

bearing takes thrust in either direction and the method of mounting adds greatly to the rigidity of the propeller in flight and gyroscopic forces are well taken care of by this arrangement.

Crankcase

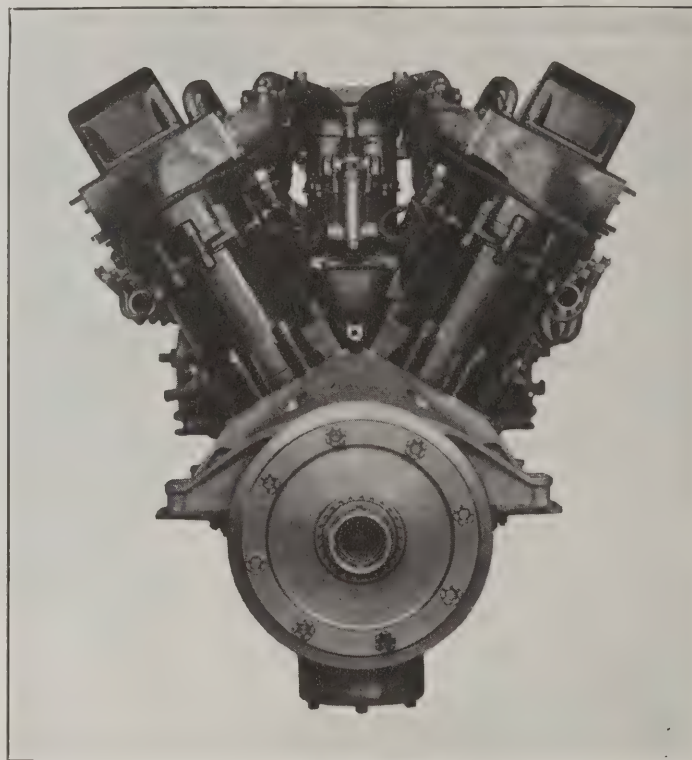
The upper half crankcase cast from an aluminum alloy is practically the same as on the CD-12 with the exception that the nose has been shortened after removing the propeller and electric started bosses. The cast aluminum main bearing caps have been replaced by duralumin forgings having four times the strength for the same weight. Each cap is carefully keyed to the crankcase to prevent it from shifting during operation.

Bronze backed babbitt-lined bearing shells are used, held in place by countersunk head brass screws. The babbitt bearings are bored to size in a boring mill, thereby maintaining the clearances in all bearings the same and insuring perfect alignment.

Accessory Drive Shaft and Gearcase

On the anti-propeller end of the engine is mounted a typical gear-case as used on this type of Curtiss engine. The gearcase has been redesigned to provide better accessibility and to make provision for mounting of the Air Service gear gasoline pump as well as gun generator drives. The use of this type of gearcase facilitates production and permits lighter weight. As used in the CD-12 engine all shafts and gears are assembled using stub-tooth teeth as splines. Altho the engine has a 60 degree angle between cylinder banks, the vertical drive shaft is brought to a height where 90 degree drive shafts run directly to the bevel gears on the exhaust camshafts. The tachometer drive has been removed from the vertical shaft which runs $1\frac{1}{2}$ crankshaft speed and has been taken off of the left hand exhaust camshaft thereby simplifying the design and making the drive more accessible. All gears have stub teeth.

A very satisfactory magneto coupling drive has been developed for the D-12 engine. This drive consists of a combination of an Oldham coupling and thermoid disc with a micrometer adjustment obtained by the use of a series of holes of different total number in two discs. The Oldham coupling takes care of all offset and thermoid disc takes care of angular misalignment as well as protecting the magneto from gear shocks.



End view of the Curtiss CD-12 Aero Engine

The water pump design has been changed to provide a ball bearing in the water pump in place of a plain bearing and a splined shaft drive in place of the squared coupling formerly used. Adequate glands have been provided to prevent both oil and water leakages. An Alemite connection is used on the water gland to keep the packing lubricated to prevent leakage. The lower vertical drive shaft is designed to drive the Curtiss triplex plunger gasoline pump in Army Air service gear pump the upper end of the upper vertical shaft is indirectly splined for a Liberty generator. The gear-case is provided with a boss to take the Bijur anti-propeller end starter.

Pistons

The same type of piston is used as in the CD-12 engine, being the ribbed head type, which gives a light weight piston of considerable strength. The rings have been lowered to provide a wider top land and to make the rings all the same width, namely, 3-32.

The piston pins float in the pistons and connecting rods being held in place by means of piano wire snap rings. There has been no change in the connecting rod assembly, this being the articulated type, the short rod being forked over a boss on the master rod. Non-gran bushings are used for the wrist pins and piston pins.

Lower Half Crankcase

The lower crankcase has been entirely redesigned to eliminate the tank which was formerly built in the engine. The oil pump was redesigned, three separate pumps being used instead of the three gear suction pumps and the two gear pressure pumps. By this means weight was saved and the drive of the pump was greatly simplified. The oil pump is driven from the lower vertical shaft in the gearcase thru spur gearing, a team of three gears being used. The middle gear is adjustable to obtain the proper gear back lash without necessitating careful machining for center distance.

Carburetion

At the present time the engine is fitted with two Zenith U. S. 54 carburetors which have been rebuilt to provide parallel throttles and an improved mixture control. The changes with the proper carburetor setting has given an extremely flexible engine coupled with wonderful acceleration without sacrificing maximum power. The two carburetors are inter-connected with a cast aluminum air duct, which obtains air through a sheet aluminum stack from outside of the airplane body.

Ignition

Two single spark 12 cylinder Spaldorf magnetos model SS12 are used.

or ignition on the engine feeding two spark plugs per cylinder placed diametrically opposite. One magneto is wired to the exhaust plugs and the other to the intake plug. The use of these magnetos has resulted in the saving of over six pounds total weight without a sacrifice of performance or reliability.

Cooling System

The cooling system had only a few slight changes. The pump has been redesigned as stated above, the double shrouded type of impeller being retained. The capacity of the pump has been increased slightly. As before the pump delivers water thru distributing manifold on the lower end of each cylinder block, discharging at the top into another manifold. This engine has been designed to use water manifolds for the outlet directly on the cylinder head thereby eliminating the objectionable feature of passing water thru the intake manifold gasketed joint.

Lubricating System

The conventional Curtiss lubricating system is used on this engine, being refined to such a degree that a consumption of .015 pounds per B. H. P. per hour may be used as an average figure for continuous flying. Minimum figures of one half this

value have been obtained in block testing. The scavenging pumps, which are now entirely separate eliminate any chance of air entering the system and thereby destroying the pump capacity. These scavenging pumps have been increased fifty per cent in capacity. All plain bearings in the gearcase are pressure fed with the exception of the lower vertical shaft which runs in a bath of oil. All other bearings are splash fed by the oil running back from the camshafts which are carefully housed in with an oil tight housing.

Propeller Hub

The propeller hub has been redesigned so that standard Liberty bolt size and bolt circle are used. A novel use of duralumin has been made by the use of this material in the loose flange.

Gasoline System

The gasoline system used on the high speed airplanes using the D-12 engine consists of the Curtiss triplex gasoline pump feeding gasoline directly to the carburetor, an overflow being provided from this pump to take care of the over capacity of the pump. The gasoline is fed with a relief valve to maintain a constant pressure. This type of pump gives positive priming and unusual reli-

bility since the pump is oiled under pressure against leakage past the pistons and the speed of 325 r. p. m. is very low.

Summary

With the above changes, an engine has been obtained weighing 670 pounds without water and delivering 400 B. H. P. at its normal speed of 2000 r. p. m. By the use of higher compression ratios and doped fuel as well as higher speeds this power is materially increased so that the result is an engine which develops a minimum of 430 horse power at 2100 r. p. m. The engine has been submitted to a Navy 50 hour test showing very good performance and other tests are now being conducted during the production of more engines.

The B. M. E. P. obtained in this compact engine are as high at 2000 and 2200 r. p. m. as obtained usually in an engine running at 1800 r. p. m. The Curtiss D-12 engine represents more nearly the ideal airplane engine than any other motor owing to its light weight and low head resistance per horse power which allows the engine to operate at light power having a tremendous reserve power for emergency coupled with reliable operation at full power.

Uppercu, President of the A. C. C. One of America's Most Enthusiastic Supporters of Aviation

IN the election of Inglis M. Uppercu as president of the Aeronautical Chamber of Commerce, a pioneer in American aviation, who as hitherto remained comparatively little known, come prominently to the front. He is unique in the automotive world, in that he has for years been one of the most successful distributors of motor cars, and as such is a powerful figure in the automobile business, while throughout a long period he has consistently devoted a considerable portion of his income to the development of flying. The aircraft industry is probably the most talked of industry in the country today. Hardly a group of business men assembles without a discussion of aeronautics. Yet, as Mr. Uppercu once phrased it: "If you passed the hat you wouldn't get a nickel." The difference between the new head of the Aeronautical Chamber of Commerce and many of the talkers is that Mr. Uppercu backs up what he says. First and last, in the past twenty years, he has invested nearly \$30,000,000 in aviation, first in experimenting and later in

scientific research and the practical operation of aircraft.

Mr. Uppercu was born in North Evanston, Ill. As far back as he can remember kite flying held him fascinated. When he was a little boy his parents moved to Montana and there, in the winds that frequently swept the hills and high plateaus of his father's sheep ranch, Inglis had opportunity to test new kites and to dream, like so many others have dreamt, of following the eagles in their swift strong flight. His Grandfather Hildebrand loved kites, too, and together the old man and the little boy would construct new devices for the air. Whenever the father took Inglis on even the shortest trip from home, the lad, on his return, would invariably find Grandfather Hildebrand with a new kite sailing high to welcome him back.

As he learned to read, Inglis obtained a set of books called "Science For All" and the flying and balloon sections of these, meager enough at that time, he learned almost by heart. So convinced did he become that it would be possible for him to

fly that, when about 5 years old, he built a "flying machine." A cracker box was the fuselage and the first wings were made like kites, but they appeared too flimsy. So the boy obtained a pair of eagle's wings and tacked them on. With his sister, a few months older, he held many conferences as to the time they would be gone, where they should go—the provisions they should take. At last, one night, when, in the clear air, the brilliant stars came close enough to reach, Inglis and his sister dragged their "airplane" to the roof of the shack, and were about to "take off" when their father interfered.

The next stage came several years later. The family were living in St. Louis. Next door was the home of a mechanical experimenter who was later to make a name in the automobile industry—Chas. E. Duryea. Mr. Duryea's immediate problem—it was in 1886 or '87—was to make the primitive high wheel bicycle safer. But he and the youth used to talk about flying and Mr. Duryea made many models which sustained

the youth's interest and hope. Mr. Duryea soon went to live in Washington and the Uppercu to New York. On one of Mr. Uppercu's visits to Washington, Mr. Duryea said: "Inglis, you and I will have to get a 40-acre lot and build a flying machine factory in the middle of it."

About 1890 Mr. Duryea had his work on the internal combustion engine well under way and gave Mr. Uppercu his first job. In 1901 or 1902 (the very time Langley and the Wrights were experimenting) Mr. Duryea built a 50 h. p. 3 cylinder airplane motor which weighed but three pounds, per horsepower, remarkably light considering the knowledge of the period. Mr. Uppercu's association with Mr. Duryea gratified the boy's ambition to work with "moving things" and Mr. Duryea's interest in flexing undoubtedly led Mr. Uppercu some years later, when the automobile business had enabled him to lay the foundation of a fortune, to give substantial aid to aeronautical research.

In 1908 Frank Boland of Rahway, N. J. built a tailless airplane that flew successfully many times. It was with Mr. Uppercu's help that Mr. Boland made his early experiments and it was with Boland, in the fall of 1908, that Uppercu took his first flight. What the boy, on the Montana plateaus, instinctively *believed* about the air, the man, now actually *felt*. The air was not simply an invisible, entangible, ether; it was sub-

tance; it was stable; it was capable of supporting a man and a machine. The old Boland aircraft, crude as it was, has a distinct place in the progressive line which is manifest today in the planes and boats built by the Uppercu interests.

The investment of a few hundred dollars in 1908 was consistently increased and small plane and motor plants were built under Mr. Uppercu's patronage, first at Newark, then at Nutley and finally at Keyport, N. J. The firm was originally known as the Boland Airplane Co. In March 1914 it was desired to re-incorporate and it was Mr. Uppercu's aim to provide an expressive, descriptive name. He had the example of his automobile business. In 1902, when it became apparent that automotive transportation had before it a great popular future, Mr. Uppercu incorporated under the name of "Motor Car Company of New Jersey." So far as there is record, it is declared that this was the first notable use of the term and his friends credit Mr. Uppercu with actually having originated it. The aircraft company, in 1914 was well along in the development of marine flying craft. Mr. Uppercu then coined the word "Aeromarine" which has since become known the world over. The Aeromarine Plane and Motor Company thus came legally into being.

From 1908, when he flew numbers of times with Mr. Boland, Mr. Uppercu had not, up to the fall of 1917, been in the air. It so happened that

his reintroduction to flying came through a naval pilot whose idea of aviation was to scare his passengers and then pose as a hero engaged in desperate occupation.

"When we alighted," said Mr. Uppercu, "I thought, 'If this is flying, it is folly to attempt to commercialize it.' So he set about learning the truth. He picked his own pilot and from that time on the word "Aeromarine" became synonymous with safety and sanity. "I had first to sell flying to myself," said Mr. Uppercu, "before I could hope to sell it to others." So he learned to fly.

In the five years that have elapsed since that experience, Mr. Uppercu operating company, Aeromarine Airways, has flown hundreds of thousands of miles transporting many thousands of passengers in comfort and security. He has established lines between Key West and Havana, New York and Atlantic City and Cleveland and Detroit. These services were the first in the United States and to date are the only ones maintained on schedule. The manufacturing corporation, the Aeromarine Plane and Motor Company has greatly expanded in the last few years and at present is engaged in War, Navy and Air Mail contracts aggregating one and a half million dollars.

Mr. Uppercu's chief automobile interest is the Cadillac Motor Car Company of New York, of which he is President.

The Silencing of Aircraft

THE muffler on an automobile is a requirement of law. It is natural to suppose that aircraft will be required to meet similar conditions the moment flying noise becomes a nuisance and this is only a matter of time when the volume of air traffic is sufficiently great. Legislation will eventually force aircraft muffling, even if the obvious advantages remain unheeded.

Military and Naval

The good results of silencing are obvious. These are set forth.

As airplanes, for example, can be heard from a great distance, long before they can be seen, listening devices which show location and distance enable the enemy to be forewarned and prepared. By muffling, machines can get nearer the enemy before being perceived and carry out their work at a lower altitude and

with greater surety. At night, the advantage is probably increased.

The pilot and observer can carry on conversation without the use of signals or telephones.

By the use of a cut-out, signals can be made from one machine to another in formation flying. Signals may be made to the aerodrome.

The noise of the engine is an obstacle in radio communication.

The noise of an unmuffled engine has an undesirable effect on the pilot's system.

Though no regulations in the U. S. have thus far been made, it is obvious that aircraft will have to be muffled just the same as have motor boats and automobiles. Because of this novelty of aircraft, have they escaped prohibition of noise.

Passengers will want to converse during flight.

The continual roar of an engine is objectionable to the ears of paying guests. Every other method of transportation strives to afford the utmost in convenience and comfort.

The Noise of Flight

The noise caused by an airplane arises chiefly from two sources. These are: 1st, the noise of the exhaust gas leaving the engine. 2nd, the whirr of the propeller. Since the noise of the engine is much greater than that of the propeller, if we can deaden it, or do away with it altogether, we have done perhaps, all that is necessary.

From a military point of view it is necessary for the machine to fly absolutely without noise, either from the engine or from the propeller. The simplest method of reducing the noise of the propeller is to reduce its speed of rotation. The usual type of propeller re-

olves at 1400 to 1800 r. p. m. Besides the inconvenience caused by the noise, this speed has the disadvantage of causing considerable loss of propeller efficiency. In order to avoid this double inconvenience, many aviation factories, specially in England, have long made engines with special gearing, reducing the speed to between 700 and 900 r. p. m. In most cases these engines are fitted with four-bladed propellers. This arrangement allows of reducing their dimensions, increasing the efficiency, and reducing the danger of breakage. The resulting lessening of noise is not perceptible, however, on account of the all-dominating intensity of the noise of the escaping exhaust gas.

It has, however, been proved that during a glide the noise is no longer audible from the ground, even when the machine is at an altitude of but 500 to 700 meters and the propeller is turning at 500 to 700 r. p. m. There is thus no doubt that the combined use of a deadened propeller and a silencer adapted to the engine provides an almost perfect solution of the problem of the silent airplane.

The noise of the engine is caused by the energy of the exhaust gas which leaves the cylinder at great speed, with a considerable amount of heat, and at a pressure of 5 to 7 atmospheres. The silencers used in automobiles are built on the principle of the discharge of the exhaust gas into voluminous manifolds in which the gas is forced to change its direction frequently, which tends to a reduction of speed. This method of deadening the sound has several technical defects of which the following are the chief: great volume, consider-

able weight, great resistance to escape and consequent loss of power in the engine caused by back pressure. Increasing exhaust resistance also causes over-heating of the cylinder walls. The silencer now used in automobiles causes a greater quantity of exhaust gas to remain in the cylinder after the stroke of the piston, the temperature of compression to be higher, combustion to be incomplete on account of the unfavorable composition of the gaseous mixture, the gasoline to mix in the cylinder with too much exhaust gas and the fouling of spark plugs and valves.

In Switzerland, where the authorities banned flying entirely near Lucerne until engines were muffled there has been developed the "Ad Astra" silencer, a note on which was published in *Aerial Age* of January 2, 1922. An observer reported: "There was scarcely any noise from the airplane during flight. At an altitude of 1000 m. only the propeller was heard. Other machines were up at the same time, and the difference between them and the one fitted with the silencer was striking. According to the date given by those checking the tests, there was neither loss of engine power, nor greater heating. It was even found that there was economy of fuel. The silencer can easily be placed in a suitable housing on the 'plane so that there will be no increase in head resistance."

This speaks in behalf of the airplane, with usually but 300 or 400 horsepower. One may well think of the airship—there is the ZRI of the Navy with six 300 h. p. engines—and its increase in volume of noise.

The requirements of a muffler

may be summed up as follows:

There should be no objectionable loss of power. In tests of certain mufflers by the University of Michigan a loss of less than 1 per cent was shown.

There should be a saving of fuel.

Better cooling of cylinder walls should be obtained.

Cleanliness of spark plugs and valves.

Exhaust gas should be thoroughly cooled as it leaves to avoid the present danger of fire.

The muffler must be capable of being easily incorporated in the design of the aircraft.

The weight of the device should not be prohibitive. For 250 horsepower it should not weigh more than 20-25 pounds.

Shape must be favorable for the reduction of head resistance.

Quick detachability is desired.

The more rigid requirements of the aircraft muffler will when met, add much to the pleasure and economy of automobile transportation. An evidence of this benefit is furnished by the tests in 1915 of the University of Michigan in which some commercial automobile mufflers lost 14 to 18 per cent of the engine power. Such loss is expensive as well as needless.

In the matter of mufflers alone, it is evident that the automobile will again benefit by the airplane.

Those concerned in this work will be interested in Reports nos. 10 of 1916 and 55 of 1920, of the National Advisory Committee for Aeronautics, Washington, D. C., which reports cover the only work officially done in mufflers in this country, so far as is known. In these experiments a 75% reduction in exhaust noise was found certain of easy acquirement.

American Airplane With Change Speed Device

90 Mile Speed Range—Ceiling Increased Over Half—Climbing Speed Raised 31%—A New Era Promised

A device which will add 40 per cent to the high speed, reduce the landing speed by 26 per cent, add 1 per cent to the ceiling and cut 1 per cent from the time of climb to 15,000 feet of the standard airplane is the claim of an American in China, J. J. Dill, whose apparatus may be fitted to any ordinary machine and operates to change the angle of incidence of the wings, will during flight from zero to 90 degrees.

A series of test flights have

recently been made by a military pilot at Harbin of a machine fitted with the Dill device. At a fixed angle of $3\frac{1}{2}$ degrees the average speed was about 94 miles an hour, with a Rhone 110 h. p. engine, despite the fact that the power plant was in bad order. In the second flight exceptional results were had with the device in operation. An altitude of 6560 feet was reached in 4 minutes with an angle of incidence of 6 degrees. During this flight the pilot changed

the angle of incidence from 2 to 8 degrees. The corresponding speeds in horizontal flight at 2000 metres (6560 feet) with various angles of incidence, as shown by the speedometer, were as follows:

Angle of 8 degrees, speed 65.62 m. p. h.

Angle of 4 degrees, speed 90.62 m. p. h.

Angle of 2 degrees, speed 103.12 m. p. h.

"The alteration of the angle of incidence in no way affected the

control of the rudders, and the variations did not make any pressure on the control stick; and the stability of the machine was in no way affected, having the same aeronautical qualities at the different angles," reads the pilot's report "The landing was easily made in the space of 82 feet with an angle of 6 degrees."

"The invention makes this airplane entirely different from any other I have flown, the difference being: (1) the short run required in starting and landing, (2) the rapid high climbing power, and, most important, (3) the different speeds obtained during horizontal flight, which can be changed at will in wide limits without any change of motive power.

"In my opinion the building of machines with high powered engines of 300 to 600 h. p. and more, and fitted with the Dill invention, will create a new era in aviation and make it possible to get the highest speeds, such as would be impossible without the invention, and with full load allow a machine to successfully take off and land."

The present day airplane, with fixed wings, may be compared with an automobile with powerful engine but with but one speed. An airplane of high horizontal speed must necessarily take off and land at comparatively high speed; and the machine with slow take off and landing is impracticable for military and high speed commercial purposes.

An airplane with a high climbing speed and capable of attaining a great altitude usually must have a powerful engine, or a high angle of incidence. In the first instance, it is expensive and in the second the plane must necessarily have a lower horizontal speed. In both cases, the machine has but one horizontal speed for any non-variable wing setting. To beat this situation, the changeable angle of incidence provides a radical solution.

The experiments, which are reported to have covered eight years, with official observation beginning in 1919 at Omsk under a Kolchak government commission and later at Harbin with another machine, are said to prove:

"By means of the Dill invention it is possible to alter during flight the angle of incidence of wings, smoothly and without any strain on the pilot.

"The alteration of the angles

does not in any way affect the stability of the machine.

"The mechanism itself has an insignificant weight, and does not affect the strength of the machine.

"For the different angles the strength of the truss remains unimpaired."

The following comparison is made in the report of two airplanes of the same kind and characteristics:

Weight2400 lbs.
Power plant300 h.p.
Wing surface..280 sq. ft.
ProfileRAF 15

In this instance one machine is supposed to have no adjustment for altering the angle of incidence and has a fixed angle of 2 degrees. The other is supposed to have the Dill invention attached by which the angle can be altered from 0 to 10 degrees during flight, at will. Com-

paring the two, a report by an observer of the test flights states the following figures:

SEE COPY FOR TABLE

With the first machine, a biplane 2-seater, with 110 Rhone, the 1919 tests results in the following performance:

Climb to 6560 ft. with full load 10.7 min.
Climb to 14,760 ft..... 48 min.
Take-off distance .. 197 ft. max.
Landing..... 295 ft. max.
Speed at 8 deg..... 75 m. p. h.
Speed at 4 deg..... 875 m. p. h.
Speed at 0 deg..... 112.5 m. p. h.
The idea of changeable angle of incidence is not new but no practical device has yet been placed on the market. This scheme would be of inestimable value to the air flivver to which we are looking but which manufacturers are reticent about producing this, and a reversible "prop."

TYPE	High Speed in m. p. h.	Low Speed m. p. h.	Ceiling feet	Time of Climb to 15,000 ft.
Dill machine	160.7	66.7	17,250	13.52
Ordinary machine	114.7	90.	26,080	19.72
Percentage	40%	26%	56%	31%

An American DH4 performance is cited below for purposes of comparison

DH4	124.0	61.5	17,600	40 min.
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Flying in California

By R. J. Smith

TO those who are contemplating inaugurating an aerial transportation line and have sufficient money, backbone and ability with which to feed it during its infancy, the Pacific coast offers unlimited potentialities. On the other hand, individuals or small companies who are financially weak might more profitably go elsewhere, for California has already many such companies who are "just about making expenses" or, in the language of the individual "free lance," doing "not so good." At the time of writing, most of the last mentioned are "doing the small towns." Eastward, business as a "joy hop merchant" being slow in and around San Francisco, pilots without planes and jobs are plentiful

here, too, although most of them, owing to the state law governing aircraft, hold state licenses.

The West today needs and is well able to support, reliable aerial transportation lines, which have, as before stated, sufficient money, backbone and ability behind them to be able to overcome all obstacles which might present themselves the first year, and present and maintain a regular service on schedule between certain cities here. The companies running these lines could safely start with large planes capable of carrying 10 or more passengers each, for in the writer's opinion the introduction and sight of these large aeroplanes would impress the public more favorably than a smaller model; in fact it is doubtful if the latter type would be

avored at all. An instance might be quoted here as an example. Recently an organization inaugurated a flying company here in San Francisco. It was advertised that the planes owned by the company would maintain a schedule and fly between Los Angeles and San Francisco. The planes to be used were "Standards" with "Hisso" motors and some were converted to carry four or five passengers, I believe. I have a great respect for both this type of plane and engine, but venture to say that a "Standard" fitted with a "Hisso" motor is hardly a "five place job" or even a four. Needless to add, this company did not succeed here. But bring the large plane, put it on the same route, advertise extensively and sensibly, secure the services of an efficient personnel, a flying manager, one who will keep the planes in the air, let discipline be the company's slogan, and the spirit of esprit-de-corps prevail, and I feel positive success will be the reward. Then from San Francisco to points up the Sacramento River, sea planes or flying boats could be put into profitable service. One might ask how the public would take to it. Whether they would immediately or not is rather hard to say, but I think they would, especially the people of San Francisco. They would, I think, start the ball rolling and then the rest would follow suit. My reason for saying this is because the fliers of Crissy Field, both Air Mail and Army pilots have by their excellent flying shown the public here and for miles around that flying is safe in all weathers. These officers have much to be thanked for by commercial interests, for they have efficiently "paved the way." One sees perfect formations passing over the city and the bay almost every day. They fly at safe altitudes and sanely. I have often heard people remark, "How safe they always look up here." Also there are a good many who judge the time of day by when the mail plane goes out and comes in, so regular is the schedule.

The aeronautical organizations in

the East would profit by investigating and taking advantage of the possibilities here.

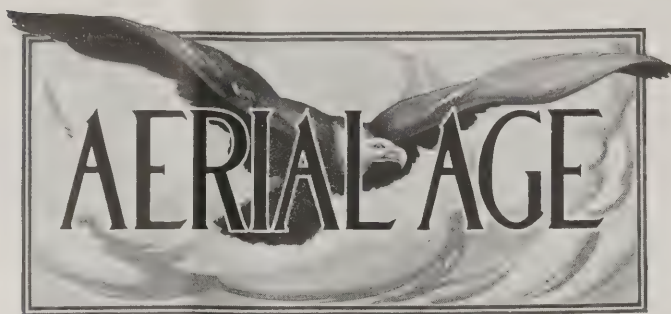
San Francisco seems to be favored as an ideal city in which to hold conventions. Hundreds of thousands of business officials flock here yearly from all over the United States, and apart from one or two "joy hop" planes, there is no aircraft service to offer them. This year there were over 300,000 "Shriners" in town for their convention. The Army pilots gave them an exhibition of good flying. Capt. Yerex, the British R. A. F. pilot and another whose name I do not know, flew over the town at night giving acrobatic flying displays in an illuminated plane throwing fire, but nothing serious was done in the way of sight-seeing trips. In fact, I think I can safely say not more than 50 (if that) even flew out of the whole 300,000. Let us assume that there had been an organization operating large planes here at the time. They would have reaped a small fortune in sight-seeing trips alone. Another point worth considering is the fact that these Shriners came from all corners of the country and are now "back home" talking about all the excitement they had here. The same thing happens when the men taking part in future conventions return to their home town. An aerial transportation line would therefore receive much invaluable publicity.

The aeroplane is by no means a "new mystery" here. The public have been partially educated that flying is a safe mode of travel and it is good to note that although much flying has been done, accidents, even of the smallest nature, have been very few and even these have mostly, if not all, been due to stunt flying or taking unnecessary risks. The state law forbidding pilots to fly without licenses has, I think, improved matters considerably here. Local interest in San Francisco would, I should say, support an aerial transportation

line if approached in a tactful and businesslike way, until the line's development permitted it to be independent of any one source of revenue. Business generally is good here and where business is good so should flying be.

Let us now consider the weather and the characteristics of the ground along certain routes. Unfortunately I have not much data on the latter but this might be easily ascertained from the regular maps and from various other sources. I might say, however, that most of California is good, and although the state is mountainous only a few need be crossed to reach any point. There is generally a fog hanging over San Francisco Bay territory, but if one knows the bay and is careful this is not a serious drawback. The uneven character of the ground makes the air at low altitudes bumpy at times, but taking all in all, it's not a bad old state to fly over, from the pilot's point of view. One can judge the physical hazards here fairly well by reading the description of California in an article entitled "Information for Pilots, Giving the Practical Characteristics of the Land Along Various Routes," which is in the October 10, 1921 issue of AERIAL AGE.

This article gives but an outline of what might be here, and in fact what can be expected in the not very distant future. Much more could be said, but this outline may be of interest to those who read it. It may receive criticism. I hope it does, for that will prove interest, and if my critics will send in their various opinions to AERIAL AGE I have no doubt that the Editor would compile the data received and publish another article which would be based on the facts sent in this way, for such an article would, I feel, be very interesting and helpful to aeronautical interests.



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Detroit

AERONAUTIC history was written at Detroit, and records that are likely to stand for some time were established. Aeronautic enthusiasts rejoice that all of the contests staged were carried through without injury to any of the participants, a very remarkable event when one bears in mind the extraordinary speed which some of the machines attained.

The Curtiss Company created an enviable record by having its four machines take the first four places in the Pulitzer, a worthy testimonial to the efficiency of the Curtiss CD-12 engine, which is completely described in this issue.

Everyone concerned with the management of the Detroit events have every reason to be thoroughly satisfied with the outcome of their efforts.

National Aeronautic Association

The developments which will follow the organization of the National Aeronautic Association are being associated with interest by all interested in the advancement of American Aeronautics. There is much constructive work that requires to be done, and it is to be hoped that this new body will get down to business and endeavor to rehabilitate the sporting and social side of aeronautics, which, at the present, requires much rehabilitation. Details of the formation of the association reached us too late for inclusion in the November issue, but we hope to deal fully with the subject in our December issue.

A Woman Crosses the Continent

To Miss Lillian Gatlin goes the honor and distinction of being the first woman to cross the American Continent by the air route. She was consigned by air mail in San Francisco with her destination New York, which she made successfully after triumphal receptions at all the stops on the way. As a result of her flight millions of Americans had their attention focussed on the air mail and the wonderful work being done by it daily, and we are indebted to Miss Gatlin for her courage and enthusiasm in seeing it through.

We are getting so used to saying that America is far behind in the development of civil aviation, that we frequently fail to give proper attention to the achievements which have been made. The figures recently published concerning the past twelve months of aerial mail service give a striking record of accomplishment.

The entire aeronautic industry has been conscious of the presence of this service but its real scope and accomplishments are scarcely recognized. The figures given are for the fiscal year ending July 1, 1922.

The planes in mail service covered 1,750,000 miles and carried 49,000,000 letters. This mail totaled 1,224,500 pounds.

92.5 per cent of the trips scheduled were actually completed and 94 per cent of the scheduled mileage was actually flown. This is a record for reliability to which any commercial transportation medium might point with pride.

The air mail service is of interest to the aeronautic industry, chiefly as an experimental route of civil aviation. Its record for the past year indicates the regularity and safety with which a service of this kind can be operated in the United States, given proper organization and careful supervision.

The German Sailplanes

THE achievement of HENTZEN in the glider Vampire in the hills near Wiesbaden—he remained aloft two hours and ten seconds—amazed the professional aviators. And well it might. They knew that the gliding machines of the WRIGHT brothers could not be kept in the air for more than seconds, and that not until a petrol motor was installed in 1903 was there a flight of as much as fifty-nine seconds. Two years were to pass before their plane remained aloft for half an hour and was driven twenty-four and a half miles. At Wasserkuppe, in the Rhön hills, HENTZEN in the Vampire, with no motor to whirl a propeller, contrived to stay up four times as long as one of the WRIGHTS did in 1905, and at the end HENTZEN glided a distance of ten kilometers, a little more than six miles, before landing. What was accomplished with the motorless flying machines in the recent Clermont-Ferrand competitions seems insignificant by comparison. The French aviator BOSSOUTROT succeeded only in “flying” two minutes and fifty-one seconds in a Farman monoplane.

The reason for the German superiority cannot be found alone in favoring winds that blew “from seventeen to twenty miles an hour, with occasional thirty-mile gusts.” The French competitors had wind enough, fifteen miles an hour and more. It is evident that the Hanover Institute of Technology, where the German gliders are made, has evolved important combinations of planes or wings and operating levers.

It seems to be fundamental that in calm air such feats as those of the Germans would have been impossible. Wind was required: the more the better, short of a gale. If a light motor were installed in their “gliders,” ascents could be made and actual flights effected in a calm, Sailplane, as the Germans call the Vampire, seems to be an appropriate name.

The Aeronautic Situation in Italy

By WILLIAM KNIGHT, M. E.

ONE of the European Countries which has contributed the most to the development of Aeronautics both as science and as a branch of Engineering is Italy.

Italy is one of the few countries that can boast of having made a real and lasting contribution to the development of aeronautical research work and to the realization of some of the best airplanes and seaplanes which have been designed up to date.

In dirigible construction, Italy is competing with Germany and the performance of the Italian semi-rigid type during the war has conclusively proved the many advantages offered by this type of dirigible construction as compared to the rigid-type. Italy has exceptionally good technical men like Col. Crocco, Col. Costangi, Col. Piccolomini, Prof. Anastasio, Prof. Panetti, Col. Guidoni, etc., and designing engineers like Rosatelli, Conflenti, Tonini, Marchetti, Forlanini, Cappa, etc. Italy has trained during the war five-hundred thousand men in the aircraft manufacturing industry and when the war stopped the aeronautical manufacturing industry in this Country had progressed to a considerable extent and it was readily admitted that Italy would prove to be a dangerous competitor for the aircraft manufacturing industry of neighboring nations.

In spite of all this, Italy is to-day the only great nation in Europe which has no commercial aviation, no programs for the future, and a Government, which flinching from the results, or rather from the lack of results takes no interest at all in either commercial or military aeronautics.

In a note published by Col. Tuz. G. Cos-

tanzi on *post bellum* aviation in Italy, the author who during the war and after the armistice was the representative of the Italian Air Service to the Supreme War Council in Versailles and also technical representative of Italy to the permanent Interallied Aeronautical Commission in Paris, puts squarely the responsibility for such a state of affairs where it belongs.

Immediately after the armistice was signed, while in France, Belgium, England, Germany and Holland every effort was made for keeping alive the aircraft manufacturing industry and for developing gradually the transformation of military into commercial aviation, in Italy a process of liquidation of all aeronautical activities was started by the government and whatever was left of the war-time organization of aeronautical services, kept on changing names and shifting from one department to another.

In spite, however, of the lack of encouragement on the part of the government, and, what is worse, in spite of the handicap placed on the aircraft manufacturing industry by the lack of an aeronautical governmental policy, aircraft manufacturers, or at least the most courageous ones have succeeded in maintaining the high standard of Italian aircraft abroad where they are exported in large numbers and where they are duly appreciated.

It is not comprehensible however, when we look at the map of Europe crossed all over by English, French, Belgian, German, Swiss, Rumanian and even Russian aerial lines that Italy is the only European nation which is not bankrupt and yet does not find it worth while to develop aviation.

The British press has repeatedly announced the organization in the near

future of a large aerial transportation company operating between England, Egypt and the Eastern part of Europe. This company will be formed, it seems, with British capital and for the purpose of furthering British interests in the Orient.

The Italian press has repeatedly pleaded with the Italian Government for the protection of Italian Aeronautical interests in connection with the operation of international lines. If it is true that foreign aerial companies are going to be operated in Italy without any participation of Italian capital and without any reciprocity of advantages being stipulated for between the Italian and foreign governments, the hint conveyed in the Italian press to the Italian Foreign Office to consider aeronautics as an international issue and not as a local matter is probably justified.

At any rate we sincerely hope that something will be done in the near future for starting commercial aeronautical activities in Italy with the co-operation of the Government, aircraft manufacturers and Italian capital.

Aeronautics needs the co-operation of every nation and the good will of the people of the world in order to develop into a means of bringing together the citizens of all nations for the peaceful pursuit of their commercial interests. It would be a bad policy to establish over any nation the aeronautical supremacy of another country. It would not be conducive of good feelings in the long run and it would defeat the main purpose of aeronautics which is the international commerce in the interest of all nations.

We need co-operation in Aeronautics, we do not need individual supremacy in the air by any nation.



The Pogna-Rossi-Bastianelli flying boat equipped with four Isotta-Fraschini engines.

THE NEWS of THE MONTH

Hartford Aviation Meet

Fourteen events, calculated to demonstrate the advance in aircraft design, construction and operation during the past year, make up the Armistice Day program for Hartford's second annual Aviation Meet. City officials in charge of the municipal airport are assisting the local Aero Club to make the enterprise surpass anything of the kind heretofore staged in New England. Enthusiastic participation has been promised by the War, Navy and Post Office Departments, and liberal inducements, including free hospitality and supplies, have been offered aircraft manufacturers and operators to take part.

All participants are to arrive in Hartford and register during the afternoon of Friday, November 10. The formal program will be carried out next day, when the industrial establishments generally will close down on account of Armistice Day. Sunday will be available for passenger carrying by all who may choose to engage therein. Lieutenant Samuel T. Mills of the U. S. Air Service will be in direct charge throughout the same as last year.

"Stunt flying" will be prohibited throughout the entire meet, but liberal prizes are offered in connection with the following features: (1) Largest number of planes sent by individual, aero club or manufacturer; (2) Largest delegation sent by a Government Station; (3) Most popular plane as designated by vote of spectators; (4) Greatest mileage flown direct to Hartford; (5) Free-for-all race 45 miles triangular course; (6) Class A race for planes rated up to 125 miles per hour; (7) Class B race for planes rated up to 100 miles; (8) Altitude contest unlimited; (9) Fifteen minute altitude contest; (10) Accuracy landing from 1500 feet; (11) Free-for-all seaplane race to Springfield and return; (12) Relay race—each team to comprise two Class A and two Class B ships; (13) Bomb dropping from 500 feet; (14) Bursting toy balloons.

Announcements of the meet sent out by H. Terry Morrison, Chairman of the Flying Committee, are particularly designed to interest and aid visiting pilots. They show a general map of Hartford and vicinity cover-

showing all features of the municipal airport, and an airdscape of same from 1500 feet elevation with the city as the background. Funds appropriated by the city to relieve un-employment last spring, were expended in smoothing the surface of the 100 acre landing field, until "best in the country" has become the general verdict of visiting aviators.

248 Miles an Hour

Travelling at a greater speed than any human being ever before attained, Lieut. R. L. Maughan, a United States Army pilot, on October 16 at Mt. Clemens, Mich., set a new world's airplane speed record by covering a one-kilometre course at the rate of 248.5 miles an hour.

The record was made during official Government tests of speed planes that participated in the national air races at Selfridge Field and was electrically timed by officers from McCook Field.

Aeronautical engineers and army and navy officers who witnessed the flight were astounded. The demonstration, they declared, proved that there is no limit to the speed that might be attained in the air.

Lieut. Maughan made the record-breaking flight in the same plane with which he won the Pulitzer trophy race on Saturday. The machine is a Curtiss army biplane, powered with a Curtiss 400-horse power engine.

After setting the new record, Lieut. Maughan continued his flight to show that the tremendous pace could be maintained. On four laps he was timed at the rate of 232.22 miles an hour, and his average for eight laps was 229 miles an hour.

Examination of the machine after the flight disclosed that it was in perfect condition and that nothing in the nature of a trick flight figured in the record performance.

Later Lieut. Maughan added to the astonishment of pilots and officials on the field by flying approximately one mile with the machine on its side. The feat in reality was a flight without the aid of wings. In other trials during the day the speed record for monoplanes was shattered by one navy and three army machines.

Lieut. Barksdale covered the one

kilometre course at the rate of 19 miles an hour, and Lieut. Whitehead made 187. They drove Loening Packard planes. Capt. Hunter, in Thomas Morse, was timed at 17 miles an hour and Lieut. Calloway in the navy's bee line racer, made 177.

The trials will determine, to large extent, the type of machines to be developed for the army and navy. Maughan's flight was said to have made it virtually certain the army would select the Curtiss-Army biplane as the standard pursuit type.

Navy Tries Out Balloons to Be Towed by Warship

Successful test of a new dirigible balloon, designed, it was said, to replace the captive observation balloon of the World War, was conducted at Wilbur Wright Field, October 14, by Charles Brannigan, test pilot, of Akron, and Ensign Charles Bauch of United States Navy.

Under the test the balloon arose 500 feet in the air and was attached to a motor truck. It was pulled to various points on the field, then cut loose, and under its own power cruised about, coming back to the truck, where a drag rope was picked up and the ship towed back to its mooring.

It was pointed out that the balloon might be towed astern a battleship, and, after cruising about for observation, might again be attached to the ship. The new ship, slightly larger than a pony blimp, is ninety-five feet in length and is driven by a single motor. It eventually will be assigned to some navy aviation field, it was said.

French Flyers Fail to Equal U. S. Mark

The French aviators, Lieutenant Boussoutrot and M. Drouhin, who ascended in a Goliath biplane in an attempt to beat the American duration flight recently made at San Diego, Calif., by Lieutenant John A. Macready and Oakley Kelly, landed after having remained in the air 3 hours, 14 minutes and 32 seconds. They thus failed to equal the record of Macready and Kelly, which was 3 hours, 16 minutes and 30 seconds.

The French Aerial Federation, however, considers the mark set by

Bossoutrot and Drouhin an official world's record, contending that the American flight was conducted under such conditions as will not be accepted by the international federation, of which the United States is a member.

"I have been to America and half way back again," Bossoutrot said on alighting from the plane, wrapped up in heavy furs. The aviators were forced to land through lack of gasoline, of which they had taken 4,200 litres when they started.

The Goliath traveled 3,200 miles, according to the instruments, which were sealed before the departure. It always kept within sight of the walls of Paris and was in constant communication by wireless with the Le Bourget.

National Aeronautic Association

The recognition of the need of a truly representative national body to advance American aeronautics led to the formation of a Joint Committee in 1921 representing the Aero Club of America and the National Air Association, with Howard E. Coffin, of Detroit, as Chairman. This Committee decided upon an Aero Congress at which should be formed the National Aeronautic Association.

Temporary offices were established in Washington and in Detroit and the date of the Congress set coincident with the National Airplane Races in Detroit, October 12 to 14th, 1922. An Advance Committee on Organization, composed of five hundred leading aeronautic enthusiasts, was formed and of this body an Executive Committee of thirty was appointed. Upon the suggestions and advice of these committees the Second National Aero Congress was held.

More than four hundred delegates representative of many states, cities, civic organizations and aero clubs and various aeronautic interests, responded to the call of these committees. By-laws were adopted, officers and governors elected, and National Headquarters established in Washington. The new Association was incorporated October 14th, 1922, as a non-profit membership corporation, the papers being dispatched from Detroit to Hartford, Connecticut, by airplane, and incorporation completed on the day of adjournment of the Congress.

Officers elected were as follows: Howard E. Coffin, President; Bernard H. Mulvihill, Vice-President; Benjamin F. Castle, Treasurer; John B. Coleman, Recording Secretary. Governors elected, two from each

district, were as follows: 1st District: Porter Adams, Godfrey Cabot; 2nd District: John Larkin, Jr., Maurice Cleary; 3rd District: L. F. Sevier, R. J. Walters; 4th District: Van H. Burgin, L. Sevier; 5th District: Glenn L. Martin, Dudley M. Outcalt; 6th District: C. S. Dieman, Sidney D. Waldon; 7th District: Ralph Cram, H. F. Wehrle; 8th District: Edgar G. Tobin, William F. Long; 9th District: P. G. Johnston, C. H. Messer.

In addition, by the provisions of the by-laws adopted, five Governors-at-large are also to be elected by the Governors mentioned above. Such election will take place shortly as will also the appointment of an Executive Committee of the Board of Governors, authorized by the By-laws.

Personnel of the National Headquarters has been partially selected and installed in Washington and consists at present of men in charge of Administration, Contests and Foreign Relations, Membership, Finance Legislation and Publicity. Full membership on these various committees is now being selected by the President by and with the advice of the Governors.

Mr. H. E. Hartney has been appointed Acting General Manager.

The purposes of the new Association are briefly as follows:

(a) To maintain in the headquarters of the Association in Washington an agency capable of voicing a vigorous public opinion upon beneficial and essential legislation in all matters of aeronautics;

(b) To awaken and educate the public mind to the possibilities of aeronautics, both as a vital means of national defense and as a transportation factor in the commercial development of our country;

(c) To supply an impartial medium thru which the thought of all sections of the country may be col-

lected, collated and harmonized into a national expression of opinion;

(d) To encourage and promote the study and advancement of the science of aeronautics, and to maintain an institution which will collect and disseminate general and technical data for the development of the industry;

(e) To sanction and actively supervise under license of the Federation Aeronautique Internationale all contests, trials, competitions and other events involving aerial craft or apparatus, and to approve all records in connection therewith.

The Governors of the Aero Club of America and the Governors of the National Air Association, the two largest aeronautical bodies in America, have already voted to merge their membership into the new association and steps are now being taken to have other smaller aero clubs and flying organizations to take similar action.

Arlington Radio Station

The installation of a recording wind vane, anemometer, and sunshine recorder on the 600-foot radio tower at Arlington, Va., has been completed, and information concerning current wind conditions is now available to aviators. Data may be obtained by calling phone Washington "West 81" and asking for "Aerological data."

2. The following information of value to aviators is hereby made available:

(a) Current wind direction and velocity can be obtained instantly at all times and in any weather at an altitude of approximately 785 feet above sea level (600 feet above the surface at Washington).

(b) An indication of the thickness and probable duration of fog and low-lying clouds at Washington is given by the record of sunshine at the top of the tower.



The De Havilland 4a with Rolls Royce engine which won the King's Cup Race in Great Britain. Piloted by Capt. F. L. Barnard

THE AIRCRAFT TRADE REVIEW

Aerial Mail Performance

Ten weeks of 100 percent performance on all three divisions of the trans-continental air mail service will have to stand as the record for awhile. A radio from Iowa City reporting a default on account of bad weather ended the longest period of perfect flying the air mail has made.

From the second week in July through the third week in September every air mail plane left its field according to schedule and the mail was carried the entire way to the destination by air. Each plane carries from 400 to 500 pounds of mail containing approximately 20,000 letters on each trip.

For the last year 92 percent performance was made by the air mail. Fortified by the excellent record of this summer, it is hoped that this year's performance report will be even better.

The Goodyear Semi-Rigid Dirigible

In building its first semi-rigid airship, America will have the aid of Umberto Nobile, distinguished Italian engineer and co-inventor of the demi-rigid type of lighter-than-air ships.

Engineer Nobile, to give him his official title, is managing director of the Italian government aircraft factory near Rome, and comes to America about October 1st on a three month's leave of absence, to assist in the calculation for building the 300 foot semi-rigid airship for the U S Army now under way at the Goodyear Aeronautic factory.

The semi-rigid type of ship originated in Italy just as the rigid or Zeppelin type originated in Germany and Engineer Nobile is the foremost authority on this type of ship in Italy, and consequently in the world.

In engaging him to come to America, The Goodyear Tire & Rubber Company which has the contract for building the huge craft, wanted to take every possible precaution of safety and Engineer Nobile will personally calculate all the stresses that a semi-rigid is subject to during flight or when moored out in the open.

Engineer Nobile has just completed the designs for a new semi-rigid ship for the Italian government, only slightly smaller than the one

being built for the American Army, and expects to get back in his own factory by the time construction is under way, so he can supervise that work.

The projected American ship, also called a "mother" airship, since it can be used as an airplane carrier, will be as long as a city block and its great gas bag will have a capacity of 750,000 cubic feet. An idea of its size can be had from the fact that the largest non-rigid ships built in this country have a capacity of 180,000 cubic feet of gas, though some 203,000 cubic feet helium ships will be built next year.

It will have a speed of 70 miles per hour and a cruising radius of more than 4000 miles and will be able to pick up and release airplanes while flying at full speed.

The distinguishing feature of the semi-rigid ship is its metal keel running the length of the 300 foot gas bag. The power cars containing engines and propellers and the navigator's car are to be suspended from this metal keel, while the huge gas bag will be attached to it at intervals of 10 feet.

It will be the largest semi-rigid ship in the world when it is completed the only larger American airship being the rigid ship ZR-1 now being built by the U S Navy at Lakehurst N. J. and at Akron. The rigid ship will be 630 feet long and have a series of gas compartments or ballonets, with a total gas capacity of about two and a quarter million feet.

Both airships are to be completed next fall, and will enable the American government to test out the relative usefulness of the two types.

Aerial Photography Progressive

"The aerial camera is taking an economical and highly important part in the reconstruction of the devastated areas of France and in the restoration of the arid regions of Egypt and Mesopotamia, which in ancient times were the centers of civilization," said Sherman M. Fairchild, a Governor of the Aeronautical Chamber of Commerce, and President of the Fairchild Aerial Camera Corp. on his return from Europe.

"It is stimulating to learn that America leads the major European nations in the scientific development of aerial photography, but in the practical application of the art on a national scale we must look to France as the leader. The French, since the ending of the war with Germany, have systematically set about the development of aeronautics through utilization of every service offered.

"Shortly after the Versailles treaty was signed, a French law was passed requiring every city in the republic, above a certain size, to be resurveyed within three years. It would have been physically impossible and financially impracticable to accomplish this by ground methods. The result was that mapping by air was adopted throughout and one company alone surveyed 200 cities from airplanes.

"Aerial mapping is being extensively used by the Ministry of Liberated Provinces. The areas of France devastated during the war are being resurveyed from the air, as in many cases not only were property lines obliterated, but the records of entire communities destroyed.

"The City of Paris was mapped from the air to a scale of 200 feet to the inch, thus making it possible to identify even small buildings. Corrections, such as new structures, streets, etc., were printed in red over the existing maps. For this air mapping work the French company received the equivalent of \$400,000."

Mr. Fairchild believes that a rich field for development in aerial photography awaits American companies entering Central and South America, and such European countries as Spain, Greece, etc.

L. W. F. Giant Bomber Successful in Trial Flights

The giant bombing airplane "Owl" designed and built by the L-W-F Engineering Co. Inc., College Point, N. Y. and known as their Model H-1 was successfully test flown on Saturday 16th inst. The machine is a redesign of the original "Owl" which was wrecked at Langley Field, Va. in 1921 and much of the original

structure was salvaged. It will be remembered that the first "Owl" was a mail carrier but taken over by the Army service. It proved safe and airworthy but entirely unsuited to military requirements. While proceeding with the repair work the L-W-F. Engineers submitted designs to the Engineering Division showing a complete revision of type and suiting the machine to all requirements for a bomber of the latest class which were favorably received and authority given to proceed with the new design.

The "Owl" as redesigned has a crew arrangement somewhat similar to that proposed under the Army specification for Type XIII. Two pilots are seated in a central nacelle slightly forward of the front spar. The controls are dual or equally accessible to either man and double control wires are used throughout. A bomber's cockpit is located below and slightly ahead of the pilots. Sign communication so important in this type is very convenient. The bomber has vision slightly above the horizontal in approach and about a 15 degree trail angle and can see the nose of his bomb at all times. A rear gunners cockpit is provided in the after part of the same nacelle. A double Lewis gun on a scarf mount commands the entire upper hemisphere with a good part of the power. In addition a remote control Lewis floor gun is provided for the defense of the lower hemisphere. Provision is made for the mounting of a forward gun but this has been omitted as inconvenient for use while the dual control is in use. A crew of four is therefore required but provision is made to accommodate four additional men in the center of this nacelle if so desired.

All fuel is carried in the two fuselages minimizing danger to the crew

in case of a crash. Sufficient for over five hours at high speed is carried. A "Pyrene" sprinkler system working under pressure is installed in each motor compartment. The motor controls are very interesting and were designed by the L-W-F company known as the "Arens" control. These will be described in a later issue. A carrier for a 4000 lb. bomb is mounted directly under the lower wing. Two 2000 lb. bombs may be carried with equal convenience by mounting two additional carriers. L-W-F type monocoque construction is used for fuselages and nacelle. The weight fully loaded is given as 18,000 lbs. and 22,000 lbs. with the bomb load. The span is 106 feet and a U. S. A. type No. 6 wing curve is used. Three Liberty 12 engines are used. A speed of 106 m.p.h. has been obtained in the trials.

The trials took place at Mitchell Field. Lt. Melville was the pilot and took with him on the initial test Donald R. Black designer F. W. LaVista and Chas. Arens of the L-W-F Company. The machine was taken off after a very short run and flown for half an hour. A perfect "three point" landing was made ending the run within a few feet of the point desired. A second flight was made immediately after and a full crew of passengers taken up. Lt. Melville pronounced the machine as entirely satisfactory and a decided improvement over the original. General Patrick made an inspection tour of Mitchell Field and was taken for a trip in the "Owl". He expressed great satisfaction at the apparent ease of control.

Airplane Landing Field Layout

The September 28th issue of the Engineering News-Record contained an illustrated article on the arrange-

ment and construction of airplane landing fields, written by Archibald Black. This paper—probably the first really constructive discussion of the subject published—takes up the problem from the viewpoint of the municipal engineer.

In an editorial commenting upon the article, which appeared in the same issue, the significant suggestion is made that landing field activities may extend the field of work of the municipal engineer.

Mr. Black's paper takes up and discusses in detail each of the important points to be considered. Illustrations of possible field arrangements and of an ideal field layout are given. A novel method of layout is proposed to provide for the future expansion as the size of airplanes increases. This consists of arranging the building area into plots of 200 by 200 feet, thus permitting the erection of ultimate hangars of 200 by 200 feet should the size of future airplanes warrant this. A composite building plan is included to show that the proposed large plot can be used to full advantage for the smaller sizes of buildings in the meantime.

The size and type of runways are discussed together with recommendations for their construction. The important questions of drainage and field surfacing are considered. As there appears to be a quite general impression that grass is merely "grass", it may be news to many to learn that no less than *eight* different types of grass seed should be blended to ensure the raising of proper turf.

International location markers and field markers are described and suggestions made for their construction. In closing, the author devotes some space to a general discussion of water, power, transportation and similar facilities.



The L-W-F Owl Which Was Recently Flight Tested Successfully

ARMY *and* NAVY AERONAUTICS

Airplane Forest Patrol Commended

The excellent work performed by the detachment of the 91st Squadron (Observation), stationed at Eugene, Oregon, in connection with the aerial patrol of the Oregon forests, has occasioned much favorable comment from all sides. The following letters addressed to Captain Lowell H. Smith, in command of the detachment, tend to show the attitude of others than those immediately connected with the Air Service towards the patrol of the forests by airplanes.

A letter from the Douglas County Fire Patrol Association is as follows:

"This association has found the new system of patrolling as maintained this season to be extremely satisfactory. We believe that from our standpoint the maximum amount of good can be accomplished by the Air Service patrol as maintained this season. It affords us a much better chance of combating fires after they are located, in determining what steps to take. Taking it as a whole the service has been very satisfactory.

The patrol as maintained has also been very beneficial in making the ground force more efficient, as the men on the fires know that we have a personal supervision of their work and can tell whether or not they are using the greatest amount of effort. It also has a good moral effect on campers, tourists and stock men. We find the ranchers more reluctant in setting slashing fires without permits and the hunters and fishermen have their attention called to the fire hazard by seeing the airplanes flying over the territory in which they are located."

The following communication is from the Booth Kelly Lumber Co.:

"There has been some discussion regarding the value of the air patrol in forest fire protective work. During the present dry season, because of smoke blowing in from the north, which is the general rule and not the exception, look-out stations have been practically of no value and the vision of the patrolmen has been very limited. Observers in your ships have been able to detect fires which would not have been discovered in any other way until they had gained considerable headway. In scouting over large fires they are able to give information to fire-fighting crews which cannot be gained as quickly

or as accurately in any other manner.

It would seem that the results accomplished this year would convince the most skeptical and that should the Department at Washington know the true value of this work there would be no uncertainty regarding the future yearly patrol.

We wish to extend to you and through you to the others in your organization our high appreciation of the courteous and efficient service given our association the present season."

Captive Helicopters May Displace Observation Balloons

"Well, here it is, what good is it?" said an aeronautical engineer as he watched the successful flight of the Berliner helicopter.

"What good is a new born child?" was the retort of an army officer not unfavorably known for good ideas and initiative. "It's got to grow and make a place for itself."

The helicopter idea is as old as the airplane. Some had the idea that it could be put to practical use not only in war but in peace time. The German empire must have had some ideas when it started official work on a captive helicopter in 1916. There is still open the British prize of £50,000 for a practical device.

What might not be possible in war, say, with a little frame, an armored box for the observer, and electric motor and propellers, driven up to any desired height through electric current from the ground and held captive. Might it replace the bulky and comparatively unwieldy kite balloon. The helicopter claims the advantage of low perceptibility and therefore a small target for artillery, armament against enemy aircraft,

especially good field of fire overhead incombustibility, rapid movement to its position.

An Austrian balloon company on the front with 1 balloon required 1 automobile winch car, 2 gas cars, 3 auto trucks, 6 officers and 137 men. The hell-bent-for-helicopterists claim that the common or garden variety of helicopter needs but 2 trucks, 3 trailers, 6 officers and but 20 men.

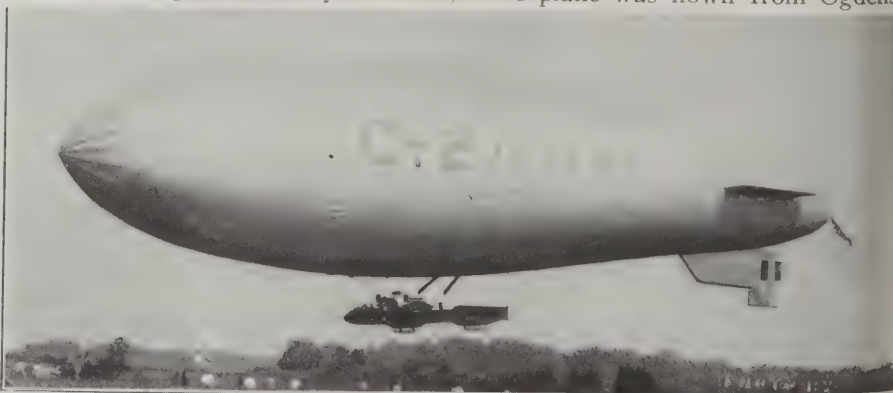
The Navy would find use for it on board ship, where the necessity for altitude is not so great as with land forces. For home defense, for search light mounts and for detection of enemy aircraft at far distances. An unmanned helicopter carrying recording instruments could be used in any kind of weather by the Weather Bureau or meteorological section of an air service. It might, unmanned, be used for radio where heavy mast are out of the question.

The thought of a captive power-driven aircraft is novel, to say the least. The use of a gasoline engine to take it from place to place might do away with the automobile trucks for transportation of an electric machine.

However, speculation as to achievement of actual sustentation of the airplane. Some had the idea that in the past. The Berliner helicopter actually sustained itself.

New Navy Training Plane

A new type of training plane for the training of student naval aviators which combines safety features never before equalled in aircraft with qualities of speed and maneuverability has just been delivered at the Naval Air Station, Anacostia, after a flight of seven hundred and sixty miles from Ogdensburg, N. Y. The plane was flown from Ogdensburg



The Army blimp which made a cross-country flight from Ross Field, Va. to Arcadia Field, Cal.

burg to Washington in ten hours flying time by Commander T. G. Ellyson, of the Bureau of Aeronautics, accompanied by G. B. Post a representative of the builders.

The plane will be known as the Huff-Navy, HN-1, and was built to Navy specifications by the Huff-Daland Company of Ogdensburg. Tests conducted at the factory and subsequent flights notably the one from New York have demonstrated excellent qualities of stability in the plane which renders it of exceptional value for training purposes.

A recent demonstration conducted by a Navy pilot under the supervision of naval inspectors showed that the HN plane was all but capable of flying without a pilot. A description of the test by Commander Ellyson is sufficient to give an accurate idea of the stability demonstrated by the plane. "In testing the plane for stability the pilot released the controls, taking his hands and feet off them. The throttle was cut to low speed and the plane went into a long glide. He then speeded up the engine and still without the controls being touched the plane leveled off and continued in normal flight with the engine turning up from 1100 to 2000 revolutions and the plane making about 60 knots. Finally the engine was speeded up with the throttle wide open. The plane began to climb and in doing so her speed was cut to about 40 knots. She fell off on the wing and dove until a speed of 30 knots was registered when the plane again leveled off in normal flight. During the entire demonstration, the Pilot, Lieut. Nielson, did not touch the control with either his feet or his hands."

The HN is equipped with a Wright engine built by the Wright Aeronautical Corporation. This is the engine which recently passed a record breaking test of 250 hours duration in a Navy test stand in Washington.

Lighthouse For Navy Pilots

A special light for air stations has been put into operation at the Naval Air Station at Hampton Roads, Va. This is a 6000 candle power white light, flashing every three and one third seconds. It has an elevation of 100 feet above mean high water and is visible 20 miles horizontally. The rays from this light diminish in intensity towards the zenith. This feature of construction is necessary in order that an approaching aviator will not be blinded by the upper rays when close to the light.

This aerial beacon is operated by acetylene and functions automati-

cally. It is controlled by a "sun valve," which works on the thermostatic principle. During daylight hours the valve is expanded by absorbed light rays and the main light is extinguished. After dark the valve contracts and allows the light to start functioning. A small pilot light is kept burning continuously for the purpose of lighting the main flame.

The object of this light is as a guide to aerial observation and to aid in locating the Naval Air Station.

Rapid San Antonio-New Orleans Flight

Captain W. P. Hayes and Master Sergeant C. W. Kolinsky of the 90th Squadron, stationed at Kelly Field, San Antonio, Texas, recently made a test flight to New Orleans, La., with a remodeled DH 4 airplane. They left Kelly Field at 6.15 a.m. and made the 560 miles to New Orleans in four hours and thirty minutes flying time, or at the rate of slightly over 124 miles an hour. One had only to do this trip by train at a temperature of 94 in the shade to become an enthusiastic exponent of aviation.

Captain Hayes reports that, although the field at New Orleans was supposed to be in good condition, well sodded, he found the grass about eight feet high. However, after negotiating a landing, it required four mules and eight men to get the ship out. The mules were furnished by the Park Department in preference to cutting the grass. Captain Hayes reports that every courtesy was shown by the city authorities and various civic organizations. They stated, in explaining the condition of the field, that Captain Hayes' ship was the first one to stop at New Orleans for some months. It would therefore seem advisable to encourage the municipal landing fields by more frequent flights.

Investigating Landing Fields.

Lieutenant C. H. Howard, Air Service, recently returned from a fifteen hundred mile cross-country trip into Maine and Vermont, where he marked emergency landing fields and selected five large tracts of land which will be suitable for use in concentrating large divisions of the Air Force in case of emergency.

Lieutenant Samuel M. Connell, Air Service, performed a similar mission through Northern New York, Connecticut and New Hampshire, traveling 1200 miles. He marked all emergency fields and located six large tracts of land near certain of the larger towns of New

York State where encampments could most easily be located in time of emergency.

Flight Surgeons' School Opens

The Medical Research Laboratory and School for Flight Surgeons at Mitchell Field, L. I., New York, opened its fall term recently with a class of twenty students in attendance, twelve of whom are Naval officers and eight Medical officers of the Army. They will remain at Mitchell Field for a three month's course, upon completion of which they will be returned to their original stations for duty as Flight Surgeons, either in the Army, Navy, or Marine Corps.

Navy TS and TR Planes

The TS-1 airplane represents the original development of the TS type and this design was prepared under Commander Hunsaker's direction to fulfill the need for a reasonably high speed combination land and seaplane single-seater fighter biplane ostensibly for use with the fleet. The type has been designed for catapulting as a seaplane from battleships and can also be launched as a land plane from an aircraft carrier.

The development of the TS type represents a distinct advance in airplane design and embodies several noteworthy features.

Wood and fabric construction is used throughout, except for struts, which are of steel. Few wires are used for external bracing, steel tubes being substituted to facilitate rapid assembly and take down, and to reduce head resistance. The upper wing is one unit and is but 25 feet in length. The lower wing comprises a center section and one outboard panel on each side. All wing and strut attachments are effected by single bolts and adjustment is provided for struts where necessary.

The overall height of this airplane has been made a minimum by placing the fuselage above the lower wing and allowing minimum clearance of the propeller above the water. Twin floats are employed, only four supporting struts being used for each pontoon and only two longitudinal bracing wires.

A noteworthy feature in the fuel system is the location of the gasoline tank, which is placed in the center section of the lower wing, provision being made to release this tank in flight in case of emergency.

The TS type is probably 25% smaller, hence more compact, than any other comparable plane known.

and this achievement has been reached by the application of the results of recent scientific development on wing, tail, and control surfaces, combined with an original general arrangement and special attention to the general and detail structural features.

It has been a gratifying result in the development of this design that the actual weight of the finished product fell within a few pounds of the calculated weight, and the high speed actually developed resulted about 2% higher than that predicted.

The modifications of the TS, such as the TS-2, TR-1, and TR-3, are experimental types constructed for comparative purposes, using different engines and wings.

The TS-1 was designed around the Lawrance radial air-cooled engine rated at 200 horse-power. The TS-2 employs an Aeromarine eight-cylinder, water-cooled engine. The TS-1 and TS-2 afford a direct comparison between the two types of engines; no actual flights, however, have been made with the TS-2.

The TR-1 and TR-3 types are practically the same as the TS-1, except that the wing section employed is different, it being intended to develop a faster modification of the TS-1 for experimental purposes. Here again a comparison between air and water-cooled engines is contemplated, as the TR-1 employs the Lawrance engine and the TR-3 the Wright Model E-3 water-cooled engine. All these engines develop the same horse-power on the block.

While these seaplanes were not designed for racing purposes, the advantages afforded of entering them in the Detroit Races have been taken, as the experimental results derived from racing in general are extremely

valuable and, of course, a racing prospect always stimulates production.

Catapults and Short Landing Devices

For many years the catapult device for launching airplanes at full flight speed from ships' decks has been a matter of experiment and practice in the U. S. Navy until it has now become a definite equipment. There remains its application to commercial or civil aeronautics, next, to permit the departure of airplanes from small spaces on the ground, or from buildings close to business districts of cities. A great drawback to aerial passenger transportation is the present necessity of an aerodrome on the outskirts—with high valuations, loss of time in reaching it, the temporary character imposed by the expansion of real estate programmes.

Coincident with this development must be that of a system for landing in about the same space. Many large buildings offer proper spaces where a suitable landing device is existent.

Many years ago Eugene Ely made one successful experiment in landing upon a platform erected above a ship's deck. The Bureau of Aeronautics of the Navy has now taken up this phase and has conducted some practical experiments which may point the way to a fully satisfactory apparatus or method.

In short, the system thus far tried consists of a series of wires placed across a platform, at a proper height, to the ends of which wires are attached weights in the form of bags of sand. The plane is brought into line with the platform and makes contact at one end in the normal manner. A hook on the landing gear

engages one of these wires and picks up the burden of the dragging weights. A second wire is engaged which adds its load to the first and so on to a point where the plane is at a standstill.

In one of the trials an airplane was brought to a stop within 38 feet. The distance depends upon the landing speed of the particular airplane. The higher the flight speed, the higher the landing speed is the usual formula.

Flying Along the New Airway.

The first official regular trip on the new airway connecting McCook Field, Dayton, Ohio, with Mitchell Field, Long Island, New York, and Langley Field, Va., via Bolling Field, Anacostia, D. C., and Moundville, West Va., was recently made by Lieutenant Samuel P. Mills, pilot, and Lieut. Van Meter, passenger. One hundred pounds of photographic supplies, destined for Washington, were carried. Excellent weather was encountered, the round trip from McCook to Langley and return being made in about 10½ hours' flying time. One unscheduled landing was made close to Cumberland on the return trip but no damage resulted.

Lieut. Mills declared himself very enthusiastic over the airways development.

The Officers of the Communication School are Capt. L. P. Hickey, Commanding, 1st Lieutenants J. H. Gardner, Stanley Smith and J. T. Harris. The Communication School Detachment consists of 21 enlisted men.

Both of the above schools are shortly expected to be in operation.

Brook's Field Gets New Hospital Plane

The Primary Flying School at Brooks Field, San Antonio, Texas, recently received a new white hospital plane, designed and built by McCook Field, and delivered via the Repair Depot at Kelly Field No. 1. This plane is a remodeled Curtiss JN6, equipped with a Wright motor 180 h.p. The fuselage is enlarged to accommodate the patient in a prone position. A seat facing the patient between patient and pilot, has been installed for an attendant. The plane with full load has been given several tests flights by pilots from the field and it is reported that, although it is an ideal ambulance plane so far as the patient's comfort is concerned, it is loggy, nose heavy and slightly underpowered. It is also slower in getting off than a Standard Curtiss JN with 150 h.p. Wright motor.

Characteristics and Performances

	TS—1	TS—2	TR—1	TR—3
Span	25' 0"	do	do	do
Length	24' 7"	do	do	do
	Lawrance	Aeromarine	Lawrance	Wright
Engine	J—1	U—8—D	J—1	E—3
Horsepower	240	240	240	240
Weight, empty	1345	1407	1345	1570
Useful load	500	500	500	500
Total weight	1845	1907	1845	2070
High speed (mph)	124*	127	136	140
Climb in 10 minutes	13000	12000	13000	11000
Ceiling (feet)	23000	22000	23000	20000

*Actual performance

The above table is for these planes loaded for entry in the Detroit Races. As service types, the useful load would be increased 180 pounds and the horse-power reduced to 220. The effect of this would be to reduce the high speed about 3%, the climb in 10 minutes would be reduced about 18%, and the ceiling about 8%.

REVIEW of WORLD AERONAUTICS

Gibraltar Aviation Base

That great Britain plans to make Gibraltar the most formidable air base in the whole world is alleged by the Spanish aviation magazine *Avear*.

"The British," says the journal, "have of recent years laid much stress on the fact that owing to changed conditions of modern warfare, both on land and sea, Gibraltar to a great extent has lost its former strategic importance. But the historic rock now enters a new phase. British engineers are busy planning the transformation of Gibraltar into a huge subterranean air station. The hillside will be tunneled in all directions, with vast cellars in which great fleets of airplanes and seaplanes will be in absolute safety from enemy attack. Huge oil tanks, repair shops, bomb and aerial torpedo stores will be complete in the mighty arsenal.

"In the centre of the rock a large hall will house the planes, with galleries running in all directions of the compass to outside landing stations. There will be several tiers connected with each other by powerful elevators. This plan will enable the British to concentrate the largest air fleet ever seen in the world in a place of absolute safety, ready at any moment to sally forth to support naval squadron or undertake offensives over a very wide radius of action.

"Gibraltar will thus regain its former importance as a strategic base, and again become the crouching lion against whom nobody will dare attempt to dispute British sovereignty over the columns of Hercules."

New French Plane

An all-metal battle plane, mounting one French seventy-five field gun, was delivered to the French Government at the Villa Coublay Aerodrome, October 15, by Schneider Steel Company, which owns the Creusot Works.

The plane is driven by four motors of 400 horsepower each. It weighs more than ten tons. Its speed is more than 100 miles an hour. It is a night bombardment plane, capable of carrying several tons of bombs in addition to two pilots, a mechanic and a gun crew. A field gun has been specially mounted on it. The plane can carry fifty shells if necessary. It already has passed the builder's trials, but has not yet begun the Government's trials.

Italian Speed Record

By attaining a speed of 209 miles an hour, Brack Papa captured the world's airplane speed record for Italy and ousted the French champion Sadi-Lecointe from a position he has held for the last two years.

The Italian made his attempt on the world's flying records over the Mirafiori aerodrome, in the suburbs of Turin, with a Fiat R. 700 biplane. In order to be officially accepted, these record flights have to be made both with and against the wind, the average time of the runs being taken as the official figure. Four trips were made over the kilometre, the fastest of these being in $10\frac{3}{10}$ seconds, or equivalent to 217 miles an hour. It is interesting to note that the first world's speed record in the air was established in 1906 at 26 miles an hour.

Brack Papa's machine is a special Fiat construction equipped with a 12 cylinder V-type water cooled engine of 700 h. p. It is with this machine that he will take part in the race for the Deutsch Cup, where he will have to meet British and French competition. Brack Papa also holds the world's speed record for 100 kilometres (62 miles) in 20 min., 52/5 sec.

Seaplane Round the World Flight.

The Air League of the British Empire is sponsoring around the world flight by seaplane.

The machine which it is proposed to use is a Fairey seaplane of the twin-float type and the machine will be driven by a 600 h. p. Rolls-Royce "Condor" engine. The three aviators who are to make the attempt are Capt. Macintosh, who has for so long been associated with the Handley Page London-Paris air services; Capt. Tymms, of the Air Ministry Navigation Department; and Capt. McCloughry, of the Australian Flying Corps. Capt. Macintosh has had unique experience of flying under all sorts of weather conditions, and he has on several occasions succeeded in bringing Handley Page machines across the Channel in weather which kept the Channel steamers in port. We do not know how much experience Capt. Macintosh has had of seaplane flying, but as the machine to be used is a twin-float seaplane, its handling should not be so very different from that of a land machine.

Regarding the machine itself, but little information is available at the moment; but it will probably follow fairly closely upon the lines of the long-distance machine on which the Portuguese aviators Cabral and Coutinho started out on their trans-Atlantic flight from Lisbon. Thus the type has been thoroughly tried out, and the lessons learned with the first machine should enable the constructors to incorporate any improvements which experience with the first machine may have suggested. We understand that the twin-float seaplane has been chosen mainly because in case of damage it is easier to repair or replace a float than it is to repair the hull of a flying boat. We do not know if it is the intention of the aviators to fit a land undercarriage for some of the stages of the flight, but it would appear that to do so would be a fairly simple procedure, and, in a measure, the effect would be similar to that of using an amphibian machine, but with the difference that the amphibian gear would not have to be carried on board. Needless to say, the machine will be very fully equipped with all modern instruments, and a wireless set of good range will be carried.

The Roll-Royce "Condor" is, at the moment, not so thoroughly tested out as is the famous "Eagle," which has the trans-Atlantic flights, the Cairo-Cape flight, and the London-Australia flight to its credit. As it is, except for size, designed very much on the lines of the "Eagle," there is no reason to think that it will not worth-



The Fokker F-3, equipped with Rolls-Royce Eagle, now in service between Amsterdam and London. It is one of the most efficient European designs.

ily uphold Rolls-Royce traditions, especially as, we understand, for most of the stages it will not be necessary to run it at anything like its full power. The most difficult parts of the journey will be from Kamchatka to Canada, and from America to Europe; and for the first part of these stages it is possible that the engine may have to be run nearly all out, until some of the fuel has been consumed. As, however, the "Condor" is very sturdily built it should be able to do this safely for the required length of time. At present the engine is, it will be remembered, being tried out in the Avro 'Aldershot,' which made its first public appearance at the Pageant at Hendon.

The route to be followed has not yet definitely been decided upon, but it will be from west to east. The Air Ministry has promised all possible assistance in the way of meteorological and wireless assistance, and it is, we believe, intended to send a spare engine out to Japan. Otherwise it is hoped to be able to complete the whole flight on the same machine. No doubt a few spares will be judiciously distributed along the route.

The actual date of starting has not yet been decided upon, but it appears probable that a start will be made early next year, possibly in January or February, and it is hoped to complete the tour of the world in about three months. We hope to be able to supplement these brief notes with further details later on.

International Air Congress in London.

Following on the Congress International de la Navigation Aérienne held in Paris in November 1921, it is proposed to hold a similar congress in London towards the end of June next year. Group Captain H. R. H. the Duke of York, K. G., G. C. V. O., R. A. F., has consented to become President of the General Council of the Congress and the Right Honourable the Lord Weir of Eastwood, P. C., has accepted an invitation to become a Vice-President. A strong Organizing Committee representative of all phases of British aeronautical activity, including the Air Ministry, has been formed, with His Grace the Duke of Sutherland as Chairman. This Committee is constituted as follows:—

Vice-Chairmen

Major General Sir F. H. Sykes, G. B. E.,
K. C. B., C. M. G.
Major General Sir W. S. Brancker,
K. C. B., A. F. C.
(Director of Civil Aviation)
Lieut. Col. M. O'Gorman, C. B.
Sir Henry White-Smith, C. B. E.
Lt. Col. J. T. C. Moore-Brabazon, M. C.,
M. P.
Brig. Gen. P. R. C. Groves, C. B.,
C. M. G., D. S. O.

Members

Brig. Gen. F. L. Festing, C. B., C. M. G.
Brig. Gen. R. K. Bagnall-Wild, C. M. G.,
C. B. E.
Air Commodore J. M. Steel, C. M. G.,
C. B. E.

Air Ministry

Lt. Col. A. Ogilvie, C. B.
Mr. Griffith Brewer
Lt. Col. W. Lockwood Marsh, O. B. E.
Royal Aeronautical Society
Col. F. Lindsay Lloyd, C. M. G., C. B. E.
Lt. Col. F. K. McClean
Mr. H. E. Perrin

Royal Aero Club

Mr. C. R. Fairey
Captain P. D. Acland
Mr. Charles V. Allen
Society of British Aircraft Constructors
Mr. G. Holt Thomas
Hon. Sir Newton J. Moore, M. P.
Mr. Shirreff Hilton
Air League of the British Empire
Sir Samuel Instone
Mr. F. Handley Page
Colonel F. Searle

Air Transport

Brig. Gen. Sir F. H. Williamson,
K. C. B., C. B. E.

General Post Office

General Secretary.

Mr. Charles V. Allen.

Technical Secretary.

Lt. Col. W. Lockwood Marsh, O. B. E.

The Congress will be open to all countries which are signatories of the International Air Convention, or are represented on the Federation Aéronautique Internationale; individual invitations are being issued through national committees in process of formation in each country. Membership will be divided into two classes: (a) Ordinary Members, and (b) Associate Members, comprising the families of ordinary Members, at a subscription of £1 and 10/- respectively.

According to present arrangements the Congress will occupy one week during the last fortnight in June 1923, the reading of papers alternating with visits to various aircraft factories and establishments. It is hoped that the Air Ministry will be able to arrange for the Royal Air Force Pageant to take place on the Saturday of the Congress week and that the Royal Aero Club may organize a race meeting on the Tuesday or Thursday. Monday, Wednesday and Friday will be devoted to the reading of papers, and discussions thereon, which will be divided into four or more main groups or sections which will hold simultaneous sessions in different rooms.

As the time available for the reading of papers will be limited a "Reading Committee" is to be formed, though it is hoped to arrange that the official report of the Congress to be published later shall contain a wider selection of the papers sent in. An official reception will be held in the evening of the Monday of the Congress

week and the proceedings will be closed by an official banquet on the Saturday.

It is important that the Congress should not be confused with the British Air Conference called each year by the Air Ministry. The latter is of a domestic nature dealing with aeronautical matters so far as the British Empire is concerned. The Congress, on the other hand, is essentially international in character and is intended to be one of a series to be held in various countries at which experts may meet to discuss the technical and scientific development of aeronautics in all its aspects.

Organization of Aerial Mails in Argentine.

In order to develop the aviation branch of the Argentine Army and to provide at the same time an improved air service from the capitol to the smaller commercial centers, the Director of the Aeronautic Service has suggested the establishment of an aerial mail system by cooperation between the Ministry of War and the Direction General of Post Offices & Telegraphs, the Department of Commerce is advised by Vice Consul Houlahan, Buenos Aires.

The plan meets with the approval of the Ministry of War and the Postal Administration, but the latter has stipulated that the administration of the service in peace times shall be under the exclusive jurisdiction of the Post Office Department since that branch of the government would be responsible to the public under ordinary conditions. The suggested route from Buenos Aires includes the cities of Azul, Bahia Blanca, Patagones, San Antonio Oeste, Rawson, Comodoro Rivadavia, Rio Gallegos, and Ushuaia.

A joint committee is now preparing a detailed plan, including the schedule of deliveries, time of flights, mail capacity for each trip, charges, etc.

London-Manchester Air Service

The first British air service which will connect Manchester and London by air is to be opened by the Daimler Airway very soon.

Maj.-Genl. Sir W. S. Brancker, Director of Civil Aviation, completed arrangements recently whereby the Daimler Airway will run one of their Napier-engined ten-seater expresses between London and Manchester daily in order to connect with the air services from London to the Continent.

From London to Manchester the air express will leave in the afternoon after the aeroplanes from the Continent have arrived at the London Air Station.

This new internal airway will bring Manchester within five hours of Paris and seven hours of Cologne, while in the Spring of 1923 it will be possible to fly from Manchester to Berlin and Copenhagen in the course of a day.

p. The engine burned 19.1 gallons of gas and 1.3 gallons of oil an hour at 1480 R.P.M., so was safe for thirteen and one-half hours.

q. Airplane gasoline was used except at Jacksonville, where high test gas not being available, commercial gas was used.

In 1911 and 1912 Calbraith Rodgers flew a Wright B from the Atlantic to the Pacific Coast in easy stages, taking weeks for the trip. Robert G. Fowler, one of the founders of the present L.W.F. company, flew a similar machine from the Pacific Coast east.

In 1919 the Army held its great transcontinental reliability test between New York and San Francisco, starting at both ends simultaneously on October 8, 59 planes participating. Forty-four planes left New York and fifteen left from Frisco. Twenty-six of the New Yorkers finished at Frisco and seven of the Californians at Mineola. Out of the total number, ten planes made the complete round trip, each crossing the United

States twice in either direction.

In February, 1921, Alexander Pearson, 1st Lieut., Army Air Service, attempted a transcontinental flight in record time. He intended to fly from El Paso to San Antonio and then to Jacksonville, Fla., for the start westerly to the Pacific Coast. During the stage El Paso-San Antonio he got into difficulty with his engine and landed about 70 miles south of the Border and suffered many hardships in getting back to civilization and gave up the flight. About three months later a salvage expedition was sent out from Del Rio, Tex., and this found the plane intact. After installing a new engine Lieut. Doolittle the new record holder, took off and flew the Pearson machine back to Del Rio although it had been exposed to the elements all this time.

On February 21, 1921, 1st Lieut. W. D. Schey made the first fast transcontinental trip, flying easterly from Rockwell Field, San Diego, in a DH4 carrying 274 gallons of gas and 24 gallons of oil. He

was forced to make a descent at Bronte, Tex., early in the morning after flying all night. Three hours later he took off and reached Dallas at about noon. Leaving here at 10:14 in the evening and made a non-stop flight to Jacksonville, Fla., arriving there February 23, after 2 days 9 hours and 24 minutes elapsed time. His flying time was 22 hours 27 minutes.

Lieut. Doolittle, the new record-holder, is the first white man to travel across the continent within 24 hours elapsed time. Prior to this flight he flew from Kelly Field, Texas, to Jacksonville. While here he flew up to Bolling Field, Washington, and from there to Dayton for consultation with the Engineering Division of the Air Service, and return. Other feats have been non-stop flights from Kelly Field to San Diego and back in easy stages and several times he has made non-stop flights between Kelly Field and Jacksonville.

Lieut. Doolittle has been ordered to McCook Field for study work.

Gliders, Sail-Planes, and the Peace Treaty

By Lieut. Col. A. Guidon,

Air Attache At the Italian Embassy

GLENN H. Curtiss, in a statement of the Aeronautical Chamber of Commerce, says:

"The achievement of the German Gliders may be regarded as a direct result of the restrictions imposed on Germany by the terms of the Versailles Treaty."

It can be of some interest to report a brief of discussions of the Aeronautical Interallied Commission in Paris, in 1919, when the question of such restriction arose.

The Supreme Council of the Peace Conference had requested the Aeronautical Commission to express its opinion regarding this point:

After the Treaty of Peace and in view of the easy transformation of commercial aircraft into weapon of war will it be necessary to prohibit civilian aviation in Germany and all other Enemy States?

The Aeronautical Commission answered YES, at majority but the delegate of the United States stated:

He was CONSIDERING all such restrictions of the entire flying activities of Germany and her Allies after the Signature of the

Treaty of Peace to be NEITHER WISE NOR PRACTICAL.

In the Report on the measures to be taken with regard to Aviation in Enemy Countries after the Treaty of Peace the American Delegation has desired to explain even more clearly its reason for voting against certain measures which it was proposed to recommend to the Peace Conference:

Certain of these measures could not be made a part of a Treaty concluded with the Enemy States. Some of these measures that could be inserted in the Treaty involve a measure of control after the signature of the Treaty of Peace, a control which the Conference of Peace has refused to impose.

Such of these measures that could not be inserted in the Treaty of Peace involve great problems of national policy and an agreement on these points, between the Nations that have been at war with the enemy States, although desiring to invite in the other Delegations of the Commission in sub-

mitting all these measures to the Conference of Peace, it should be understood that the American Delegation does not recommend their adoption and they do not wish, in any way, to bind the United States separately or in concert with any other country to adopt any one or the whole of these measures.

As a consequence, the Treaty of Peace brought no restrictions on the Commercial Aviation; such restrictions were imposed on Germany, a long time afterwards, contrary to the precise dispositions of the Treaty of Versailles.

It is quite sure that if the Congress of the U. S. had approved the Versailles Treaty, such restrictions would never have been imposed on Germany.

Soaring Flying may not have a decisive importance in the development of aviation, but it is certainly a source of useful data for the general progress of aeronautics.

The wonderful test of the German soaring planes prove how far-seeing and right-seeing the standing of the American Delegation was, when it considered any restriction of commercial aviation NEITHER WISE NOR PRACTICAL.

FOREIGN TECHNICAL DIGEST

HANDLEY PAGE TWIN-MOTORED BIPLANE

THIS new type machine, now being used on the London-Paris Service, for carrying passengers and freight, is the outcome of experience obtained in commercial transport during the past three years with our converted war and commercial machines, and develops particularly the W. S. type machine which gained the Air Ministry's prize of £8,000 for large Aeroplanes in their trials in 1919.

SALOON

The interior of the fuselage, which is entirely free of all bracing wires, stays, struts, etc., is one large saloon, 18 feet long, fitted with 12 comfortably upholstered chairs.

Racks are provided for light luggage and a map of the route provided for in the light front of the saloon in full view of all passengers; this, together with an altitude indicator, speed indicator and clock, add greatly to the interest of the passengers in their journey.

Great care has been taken to provide adequate ventilation, free from draughts, and an excellent view is obtained in all directions, due to the large windows of Triplex Glass provided.

A well appointed lavatory is provided in the back of the saloon and a cuspidor is arranged next to each chair, which can be comfortably used in the event of air sickness. Provision is also made for carrying a fresh supply of water.

The saloon is provided with a number of emergency ripping panels in order that maximum safety and the quickest exit is obtainable in the event of such being necessary. A door leads through the forward freight compartment to the pilot's cockpit in the event of communication being desirable in flight.

FREIGHT

Freight is carried in two separate compartments, each capable of carrying 6 cwt.,

one forward between the saloon and pilot's cockpit, 80 c. ft., the other, 90 c. ft., being immediately aft of the saloon. Each is provided with a separate door, so that the passengers are not inconvenienced by the loading of freight.

LOAD CARRIED

Weight light (with water)....	7,260 lbs.
Pilot.....	160 "
Mechanic.....	"
Petrol for 3¼ hours (137 gallons)	1,000 "
Oil (10 gallons)	100 "
Passengers (at 180 lbs.) (12)	2,160 "
Cargo.....	1,820 "
	12,500 lbs.

Note: It is not considered necessary that a mechanic should be carried under normal conditions.

PERFORMANCE

The certified performance is:—
With Load 12,500 lbs. 11,500 lbs.

Maximum speed		
at 1,000 ft.....	96 m.p.h.	101 m.p.h.
Ground rate climb 370 ft/min.		425 ft/min.
Service ceiling..	7,500 feet.	8,700 feet.
Landing speed...	44 m.p.h.	42 m.p.h.
Run to "get off".	320 yards.	300 yards.
Run to "pull up".	240 yards.	240 yards.

RELIABILITY

By the use of twin engines greater reliability is obtained in the machine than that which is possible with a single engine, as each engine is independent of the other in the event of a breakdown and the machine is proved capable of flying on the remaining engine.

Great attention has been paid in order to obtain a slow landing speed, which is an absolute necessity for safety.

The pilot, seated in the extreme front of the aeroplane, has an entirely uninterrupted view. A seat is provided by the side of the pilot in case it is required to carry a mechanic or navigator for special purposes.

A Marconi system of Wireless Telegraphy is fitted for the use of the pilot, and a "listening in" set is provided in the saloon for the benefit of the passengers.

EQUIPMENT

The following equipment is fitted:—
Wireless Telegraph Apparatus (Civil type)
2 Air Speed Indicators (One in Cabin)
2 Altimeters. (One in Cabin)
Lateral Clinometer.
2 Revolution Indicators.
2 Radiator Thermometers.
2 Oil Pressure Gauges.
2 Petrol Level Gauges.
2 Oil Temperature Thermometers.
1 Watch and Holder.
1 Instrument Lighting Set.
3 Pyrene Fire Extinguishers (Two in Cabin)
1 Pilot's Belt.
1 Compass.
1 Turning Indicator.

COST OF UPKEEP

Each engine is provided with a separate petrol tank which is fixed on the top plane, so that the usual power petrol pumps are dispensed with, as also the emergency hand pump and all the attendant piping, gauges and control cocks.

On account of the very large number of Rolls-Royce engine spare parts obtainable at economic prices, the engine upkeep is of particularly low cost.

The location of the engine is such that no cowling is necessary, and this fact, combined with their positioning, makes the dismantling for overhaul a very simple and quick operation.

ALTERNATIVE ENGINE

Napier "Lion" Engines of 450 H. P. may be fitted in this type machine, without any increase in weight, and the performance Maximum speed at ground.. 120 m.p.h. increased to:—

Rate of climb at ground... 750 ft/min.
Service Ceiling..... 12,000 ft.
Landing speed..... 44 m.p.h.



The Handley-Page Biplane of the Type Used in the Cross-Channel Passenger Service.

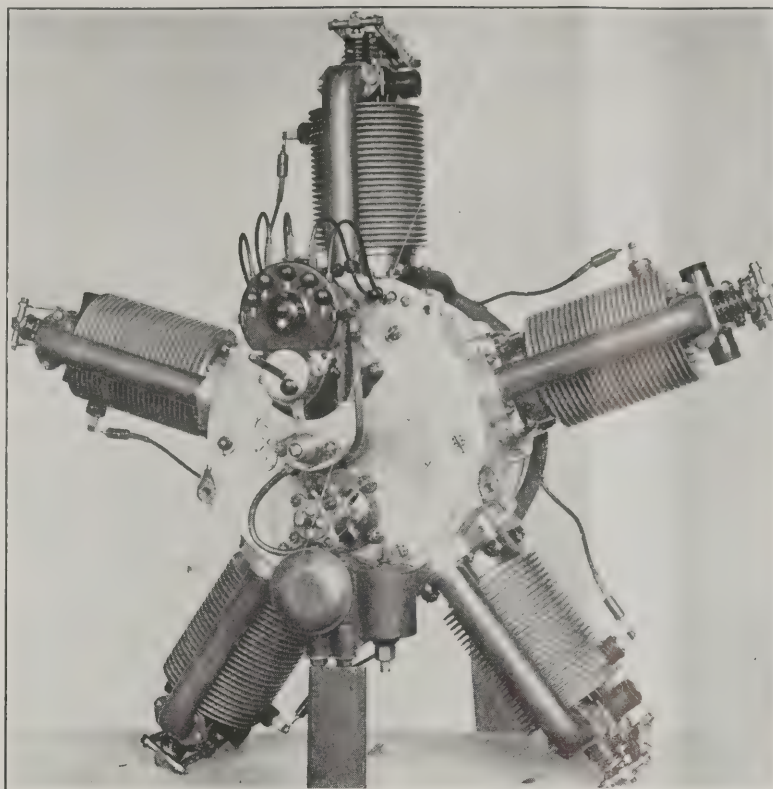
THE NEW SIEMENS-HALSKE AERO ENGINE

THE note of allies on the 14th of April 1922 making determinations to the German Aircraft Industry says in rule I: "Every one seater-aeroplane with a greater performance than 60 h. p. is taken for a military object and therefore as implement of war."

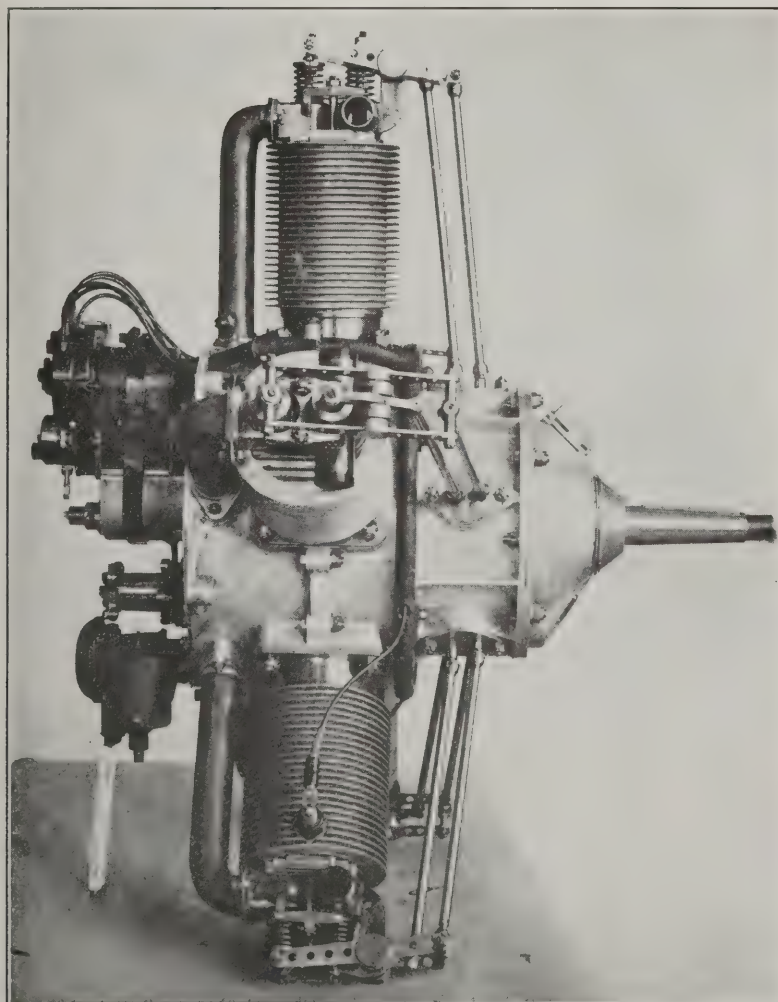
Consequently German aircraft works have built very interesting new aero engines and aeroplanes.

The new Siemens-Halske aero engine is shaped as a star-motor with 5 fixed cylinders.

It is a four stroke engine with air cooling. Its bore is 4" and its stroke 4.7". The crank shaft, constructed in highly alute material, consists of two parts with all bearings, laid in the split aluminum crank shaft chamber in bronze bushes. On the main connecting rod, likewise running in ball bearings, the secondary connecting rods are joined. The cylinders are made of steel with aluminium mantles furnished with ribs for air cooling. The pistons are made of aluminum. On the cylinders there are placed the inlet and the exhaust valve chambers. The inlet and the exhaust valves are mechanically operated by thrusting poles.



Rear View Siemens-Halske Engine



Side View Siemens-Halske Engine

The opening and closing of valves is done by tipping arms lying into each other. They are laid down in the case of exhaust valve, and the axle of which is in ball bearings. The trusting poles are operated by tappets, gliding in guides easily to be changed and operated by a cam, corresponding with the gear times of the motor. Toothed wheels lying in the forepart of the crank shaft chamber with gear ratio corresponding to the valves-operation, drive on the came, going in ball bearings. A cover of cast aluminum shuts the forepart of the crank shaft chamber. In this cover there is in a casted bronze bush the strong ball thrust bearing for accepting the shear in the axle.

In the back part of crank shaft chamber there is the suction passage for the explosive gas mixture, conducted to the inlet valves by sucking tubes easily to be taken off from a special carburetor. An air pump driven by the crank shaft by means of eccentric keeps the pressure constantly when the petrol tank is at the bottom. This pressure takes care of conducting the fuel to the carburetor. At the back close cover of the crank shaft chamber there is one high tension ignition device driven by tooth-wheels. The ignition device is secured in its position by fitting pins and kept on the bad plate by a spanning band easily to be untied. The cables are put in a pipe. Each of the five cylinders has a sparking plug. There can also be connected two magnetic devices and then each cylinder receives two separated sparking plugs. An oil pump likewise arranged at the back cover takes the oil through the hollow crank shaft to the engine parts that

(Concluded on page 571)

Publications and Technical Notes of the National Advisory Committee for Aeronautics

IN entering upon its eighth year of work, the National Advisory Committee for Aeronautics, established by an act of Congress in March, 1915, has inaugurated one of the most productive methods of research yet devised for the solution of original problems. The towing of full-sized surfaces in the air and the development of the new instruments which record photographically during actual flight the speed through the air, the variations in loading on the wings in flight and on landing or taking off, control positions and others, carry the battle of research far into the enemy's country.

All the results of the research work of the Committee are available in either printed or mimeographed form. Following is a list of the *printed* annual and separate reports. This list will be found invaluable to students, constructors, operators, users and libraries throughout the country. It is the aim of *Aerial Age* to furnish its readers with the world's aeronautical information, either directly or indirectly.

The annual reports of the National Advisory Committee for Aeronautics contain all technical reports prepared by this Committee. The technical reports are also published separately unless otherwise indicated. Those marked with an asterisk (*) are not obtainable as separate reports but are available only in the annual reports. *All reports may be had on application to the Superintendent of Documents, Government Printing Office, Washington, D. C., which should be accompanied by remittance in the form of coupons, postal money order, express money order, New York draft, or certified check. If currency is sent, it will be at sender's risk. Foreign orders should be accompanied by international money order or New York draft. Postage stamps, coins defaced or worn smooth, foreign money, and uncertified checks will not be accepted.*

First Annual Report (1915)

The First Annual Report Contains Reports Nos. 1 to 7. Price is \$.35 No.

- *1 REPORT ON BEHAVIOR OF AIRPLANES IN GUSTS.
Part 1. Experimental Analysis of Inherent Longitudinal Stability for a Typical Biplane.
By J. C. Hunsaker.
Part 2. Theory of an Airplane Encountering Gusts.
By E. B. Wilson.
- *2 INVESTIGATION OF PITOT TUBES.
Part 1. The Pitot Tube and Other Anemometers for Airplanes.
By W. H. Herschel.
Part 2. The Theory of the Pitot and Venturi Tubes.
By E. Buckingham.
- *3 REPORT ON THE INVESTIGATIONS OF AVIATION WIRES AND CABLES, THEIR FASTENINGS AND TERMINAL CONNECTIONS.
By John A. Roebling's Sons Company.
- *4 PRELIMINARY REPORT ON THE PROBLEM OF THE ATMOSPHERE IN RELATION TO AERONAUTICS.
By Prof. Charles F. Marvin.
- *5 RELATIVE WORTH OF IMPROVEMENTS

ON FABRICS.

By the Goodyear Tire and Rubber Company.

- *6 INVESTIGATIONS OF BALLOON AND AIRPLANE FABRICS.
Part 1. Balloon and Airplane Fabrics.
By Willis A. Gibbons and Omar H. Smith.
Part 2. Skin Friction of Various Surfaces in Air.
By Willis A. Gibbons.

- *7 THERMODYNAMIC EFFICIENCY OF PRESENT TYPES OF INTERNAL COMBUSTION ENGINES FOR AIRCRAFT.
By Columbia University.
Part 1. Review of the Development of Engines Suitable for Aeronautical Service.
Part 2. Aero Engines Analyzed with Reference to Elements of Process or Function.

Second Annual Report (1916)

This Report Contains Reports Nos. 8 to 12. Price \$1.25. It is regrettable that this volume is out of print.

- *8 GENERAL SPECIFICATIONS COVERING REQUIREMENTS OF AERONAUTICAL INSTRUMENTS.
By the National Advisory Committee for Aeronautics.
- *9 NOMENCLATURE FOR AERONAUTICS.
By the National Advisory Committee for Aeronautics.
- *10 MUFFLERS FOR AERONAUTICAL ENGINES.
By Professor H. Diederichs and Professor G. B. Upton.
- *11 CARBURETOR DESIGN—A PRELIMINARY STUDY OF THE STATE OF THE ART.
By Charles Edward Lucke, Assisted by Friederich Otto Willhoff.
- *12 EXPERIMENTAL RESEARCHES ON THE RESISTANCE OF AIR.
By L. Marchis.

Third Annual Report (1917)

This volume contains Reports Nos. 13 to 23. Price \$1.50

- 13 METEOROLOGY AND AERONAUTICS.
By Wm. R. Blair. (10c)
Part 1. Physical Properties and Dynamics of the Atmosphere.
Part 2. Topographic and Climatic Factors in Relation to Aeronautics.
Part 3. Current Meteorology and its Use.
- *14 EXPERIMENTAL RESEARCH ON AIR PROPELLERS.
By Wm. F. Durand.
Part 1. The Aerodynamic Laboratory at Leland Stanford Junior University and the Equipment Installed with Special Reference to Tests on Air Propellers.
Part 2. Tests on 48" Model Forms of Air Propellers, with Analysis and discussion of Results and Presentation of the Same in Graphic Form.
Part 3. A Brief Discussion of the Law of Similitude as Affecting the Relation between the Results Derived from Model Forms and Those to be Anticipated

from Full-sized forms.

- *15 NOMENCLATURE FOR AERONAUTICS.
By the National Advisory Committee for Aeronautics. (5)
- *16 THE STRETCHING OF THE FABRIC AND THE DEFORMATION OF THE ENVELOPE IN NON-RIGID BALLOONS.
Part 1. The Stretching of the Fabric and the shape of the Envelope.
By Rudolph Hass.
Part 2. The Deformation of the Envelope of the Siemen Schuckert Airships.
By Alexander Dietzius.
- *17 AN INVESTIGATION OF THE ELEMENTS WHICH CONTRIBUTE TO THE DYNAMICAL STABILITY, AND OF THE EFFECTS OF VARIATION IN THOSE ELEMENTS.
By Alexander Klemin, Edward P. Warner, and George M. Denking.
- *18 AEROFOILS AND AEROFOIL STRUCTURAL COMBINATIONS.
By Lieut. Col. Edgar S. Gorrell and Maj. H. S. Martin.
- *19 PERIODIC STRESSES IN GYROSCOPIC BODIES, WITH APPLICATION TO AIRSCREWS.
By A. F. Zahm.
Part 1. The Gyroscopic Particularities.
Part 2. The Gyroscopic Three-Dimensional Body.
- 20 AERODYNAMIC COEFFICIENTS AND TRANSFORMATION TABLES.
By Joseph S. Ames. (5c)
- *21 THEORY OF AN AIRPLANE ENCOUNTERING GUSTS, II.
By E. B. Wilson.
- *22 FABRICS FOR AERONAUTIC CONSTRUCTION.
By Subcommittee on Standardization and Investigation of Materials.
Part 1. Cotton Airplane Fabrics.
Part 2. Balloon Fabrics.
- *23 AERONAUTIC POWER PLANT INVESTIGATIONS.
By the Subcommittee on Power Plants.
Part 1. Performance of Aeronautic Engines at High Altitude.
Part 2. Radiator Design.
Part 3. Spark Plugs.

Fourth Annual Report. (1918)

In this Volume are Reports Nos. 24 to 50. Price \$1.25

- *24 AIR FLOW THROUGH POPPET VALVE
By G. W. Lewis and E. M. Nutting (5c)
- *25 NOMENCLATURE FOR AERONAUTICS.
By National Advisory Committee for Aeronautics. (5c)
- *26 THE VARIATION OF YAWING MOMENT DUE TO ROLLING.
By E. B. Wilson. (5c)
- *27 THEORY OF AN AIRPLANE ENCOUNTERING GUSTS, III.
By E. B. Wilson. (5c)
- *28 AN INTRODUCTION TO THE STUDY OF THE LAWS OF AIR RESISTANCE OF AEROFOILS.
By George de Bothezat. (25c)
- 29 THE GENERAL THEORY OF BLADE SCREWS.
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In any particular case for which the performance is known, the formula is quite accurate in predicting the effect of small changes in W., B. H. P., or S. To do this,

Equation (2a) is solved for the exact value of K by substitution of the original data and this value is used with the new values

of $\left(\frac{W}{HP}\right)$ or $\left(\frac{W}{S}\right)$ to obtain the new ceiling.

The absolute ceiling for any common values of $\left(\frac{W}{HP}\right)$ and $\left(\frac{W}{S}\right)$ may be read directly from Fig. 1 which is based on Equation (2a) with K = 19000.

Table 1.
Value of constant K in

Aeroplanes	10000		H	K	Remarks
	$\left(\frac{W}{HP}\right)$	$\left(\frac{W}{S}\right)$			
JN-4D.....	22.6	5.72	9250	17300	Landplane
DH-4.....	11.20	7.62	19200	19800	"
VE-7.....	11.60	7.36	18900	19200	"
MB-3.....	7.00	8.4	25500	18400	"
M-80.....	8.80	12.3	19900	19500	"
Nieuport "Night-hawk"....	6.60	7.77	29000	19800	"
Fokker D-VII.....	8.47	8.36	25000	20400	"
Mrtinsyde Scout.....	7.50	6.95	26800	19000	"
N9-H.....	18.30	5.54	14500	19500	Flt. seaplane
R-9L.....	10.9	7.10	20000	18500	"
HA-2.....	10.40	8.00	20500	19200	"
F-5-L.....	18.10	9.30	9500	18500	Boat seap'ne
DT-1.....	17.20	9.75	10200	19000	"
NC-5.....	21.30	9.70	6000	17000	"

(Concluded from page 563)
are to be oiled and sucks the superfluous oil out the motor and represses it to the oil tank.

The motor is hanged up by means of eyes casted on the back part of the crank shaft chamber, whereby the border of the back close-cover serves as centring.

The aero engine will be built with 5 cylinders, 50/55 h. p. for one seater aero-planes and with 7 cylinders, 80/85 h. p. or 9 cylinders, 100/110 h. p. for other aero-planes.

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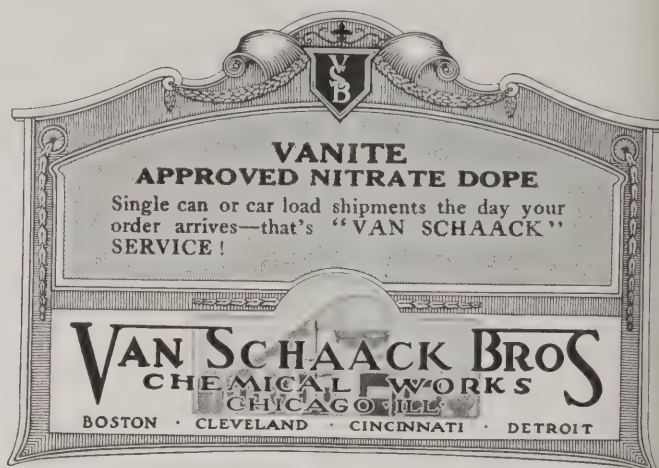
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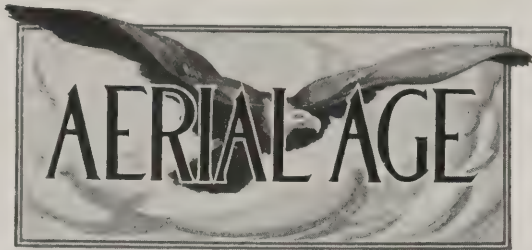
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The 1922 Finish

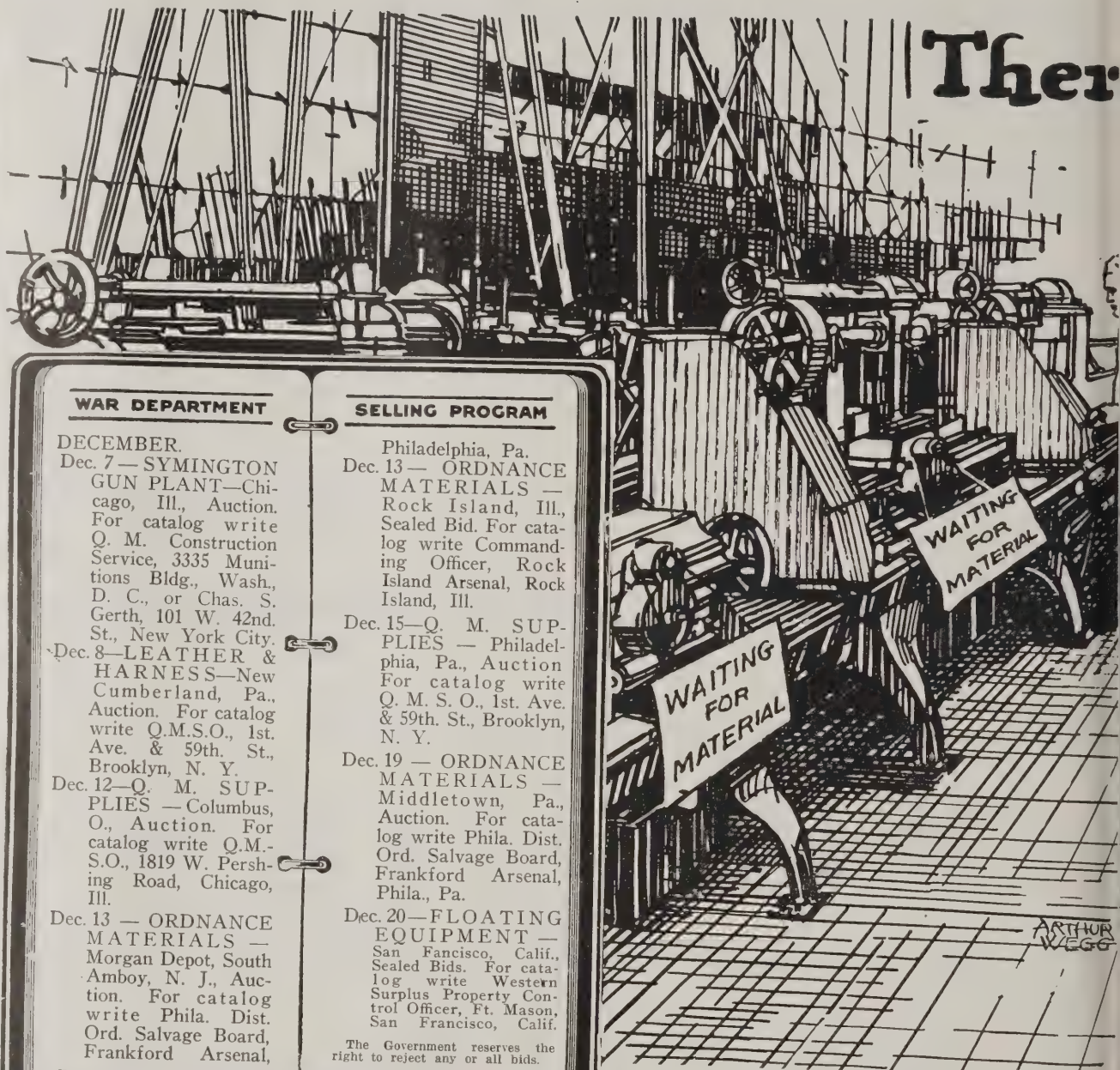
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- Dec. 7—**SYMINGTON GUN PLANT**—Chicago, Ill., Auction. For catalog write Q. M. Construction Service, 3335 Munitions Bldg., Wash., D. C., or Chas. S. Gerth, 101 W. 42nd St., New York City.
- Dec. 8—**LEATHER & HARNESS**—New Cumberland, Pa., Auction. For catalog write Q.M.S.O., 1st Ave. & 59th St., Brooklyn, N. Y.
- Dec. 12—**Q. M. SUPPLIES**—Columbus, O., Auction. For catalog write Q.M.-S.O., 1819 W. Pershing Road, Chicago, Ill.
- Dec. 13—**ORDNANCE MATERIALS**—Morgan Depot, South Amboy, N. J., Auction. For catalog write Phila. Dist. Ord. Salvage Board, Frankford Arsenal,

SEND FOR CATALOG**SELLING PROGRAM**

- Philadelphia, Pa.
- Dec. 13—**ORDNANCE MATERIALS**—Rock Island, Ill., Sealed Bid. For catalog write Commanding Officer, Rock Island Arsenal, Rock Island, Ill.
- Dec. 15—**Q. M. SUPPLIES**—Philadelphia, Pa., Auction. For catalog write Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.
- Dec. 19—**ORDNANCE MATERIALS**—Middletown, Pa., Auction. For catalog write Phila. Dist. Ord. Salvage Board, Frankford Arsenal, Phila., Pa.
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Note:—Sale of Sodium Nitrate, approximately 25,000 short tons, located at Jacksonville, Tenn., will be held by Sealed bids, closing 12 o'clock noon, December 15, 1922. For information and proposal form, address District Ordnance Salvage Board, Room 808, Army Bldg., 39 Whitehall St., New York City, N. Y.

WAR DEPT



The Loening Air Yacht in Flight

New York to Detroit via the Air-Water Route

This Story Was Written By a Woman Passenger on the Flight Described

SUCH a day! And such a Ship! Like a great throbbing bird our perfectly timed Liberty purred a welcome as we climbed aboard at Port Washington at 1:06 P. M. on Thursday, 31 August. Slowly and gently the waters of Long Island Sound slipped away as we rose to two thousand foot level and banked onto our course, headed for the blue waters of the Hudson. New York with its lofty buildings and dejected tenements soon was lost to view as the majestic Palisades guided us on our way up the wonderful river they so silently guard.

Approaching the hills near West Point we gradually increased our altitude to three thousand feet, flying in this position until after leaving Poughkeepsie, when we came down to within one hundred feet of the river. As we were nearing Albany, we sighted a New York Central train, bound for Chicago, and though it was travelling at a high rate of speed, it could not compete with our "Loening" and soon it was lost to view.

We landed at the Albany Yacht Club at 2:32 P. M. just 1 hour, 26 minutes after leaving New York. After replenishing with gasoline we were again on our way, rising at once to an elevation of 5,000 feet in order to have a good altitude to cross over Glen Falls. We passed many beautiful lakes and hills but our real treat came when we sighted beautiful Lake George lying so peacefully in the heart of the Adirondacks. After viewing the beautiful panorama spread before us one can easily appreciate why this is called "America's Playground of the Alps". We landed at the south end of the lake to take on more gasoline and incidentally a sandwich for ourselves.

We hated to leave such a beautiful spot and only the necessity of making distance pulled us away. The passing landscape as we flew over Lakes George and Champlain was very picturesque; the Green Mountains of Vermont to our right and rolling farm lands to our left, dotted here and there with small lakes and towns made the picture complete. We passed a moss-covered fort, apparently in good condition, but were unable to determine its name.

After leaving Lake Champlain we followed the Richelieu River and as we reached the St. Lawrence River, we thought it wise to stop at St. Charles, Richelieu, for more gas. This was the first ship to make a landing at this town and if Pegasus, himself, had swept down upon them, I don't think they would have been more surprised. The entire population was down at the dock to give us a super-cordial welcome. His Royal Highness, himself, could not have been treated with more prominence. Unfortunately, none of us could speak their language but a little girl acted as interpreter and we were extended every courtesy possible.

We left St. Charles at 7:37 P. M., flying north over the river to a point probably twenty-five miles north of Montreal where we crossed over to the St. Lawrence River and then turned south, passing over Montreal at 8:08 P. M. and gliding into the canal at Lachine, as the last ray of light was slipping beyond the horizon. Our actual flying time from New York was four hours, twenty-three minutes. When our ship was safely moored we motored to a hotel in Montreal where we did justice to a real steak with all of its appurtenances.

Thus ended the first day of our journey

for all except our sturdy pilot. He, who had guided us over rivers, lakes and mountains without one slip of the control and who had earned a night's repose was awakened in the wee small hours by a loud knocking on his door and two men entered uninvited, one an Assistant Manager of the hotel, the other Police Sergeant LaPorte. They turned on the light and at once began to put our pilot through the third degree, but when they found out we were just travellers with no ulterior motive other than to get our ship, as well as ourselves, safely to Detroit, they left, apparently satisfied.

The next morning we awakened to find a bright sun and a blue sky to tempt us to continue our flying, but to leave such a romantic city without seeing at least a few of its magic spots seemed criminal, so we decided to defer our leaving until later in the day and spend a few hours sightseeing. As we strolled down the main street we saw many sights of interest, some amusing. The over-dressed American tourists were quite a contrast to the Canadians in walking shoes and knickers, sauntering along, pointing with their canes to objects of mere significance. We hired an automobile to take us to Mount Royal. This was a most delightful ride and from the mountain top we were able to get a good view of the City and the adjacent country. We returned to our hotel late in the afternoon and as the "call of the air" was so prevalent in all of us, we decided to take a short hop before dinner.

We left the Montreal Boat Builders Dock at 5:42 P. M. and as we had fourteen miles of rapids to cross we climbed at once to 2200 feet. After passing Ogdonsburg, New York, we came down to

one hundred feet above the water so as to give us a good view of the beautiful Thousand Islands which we were nearing.

Looking over the blue expanse of the waters of the Islands we turned our thoughts back in the dim vista of the ages and tried to visualize this region in its undeveloped natural condition, as it was when inhabited by the Iroquois and Algonquins—when wigwams and dense forests stood in the place of stately mansions and landscaped gardens, and birch-bark canoes traversed the rivers instead of luxuriant yachts. It is then we realize how Longfellow was inspired to write his beautiful poem "Hiawatha". It would bankrupt the English language to describe the virtues of the Thousand Isles. Only by seeing can one appreciate its beauty and know why it is the chosen mecca for tourists as well as the summer playground for our country's most prominent people.

We landed at Alexandria Bay, the Hub of the Thousand Islands, at 7:20 P. M., our flying time from Montreal being 1 hour, 34 minutes.

The next morning after a short walk around the bay, we resumed our journey.

We had twenty minutes of flying over the Islands before we left the river to follow the southern shore of Lake Ontario. The air was very rough so after flying one hour and a half we landed at Sodus Point for luncheon and to wait for the wind to subside.

When we started again at 4:35 P. M. we began at once to climb and by the time we reached the Niagara River we had attained an altitude of 5200 feet. I think we had our greatest thrill at this point as we knew that soon we would experience a few minutes of tricky flying.

We passed over Niagara Falls at 6:11 P. M. at an elevation of 4700 feet. The visibility was perfect and we had a wonderful view of the Falls and Rapids from this altitude. When the treacherous waters were passed we began to gradually descend and landed at the Buffalo Yacht Club at 6:20 P. M.

We spent the night in Buffalo and most of the following day the weather was not conducive to safe flying. In the afternoon the rain ceased and the sun began to shine, so we left our mooring at 4:17 P. M., headed for Lake Erie and home.

Flying along the north shore of the lake we passed Port Carbone and Welland Canal at an elevation of 1400 feet. When we reached Rondeau Harbor we had to land for gasoline and as it had to be carried some distance it took considerable time, and we were forced to stay all night. There is no hotel there, but we were taken in by some very hospitable Detroit people and spent a very enjoyable evening.

We left Rondeau Harbor at 9:04 the next morning, following the Lake Shore to the Detroit River. Bois Blanc Island and Grosse Isle were sighted and we then knew our wonderful journey was fast coming to an end. Owing to the perfect visibility, we had an excellent view of the City and after circling around Belle Isle we landed at the Detroit Yacht Club at 10:25 A. M. The actual flying time from New York to Detroit via the water route was 12 hours and 8 minutes.

A trip in a Leaning Aero Yacht is always a pleasure but when it takes one over an ever-changing panorama of the most beautiful scenery in the world, it is a delight which will linger in the memory forever.

The Airplane Carrier Langley

OF the three new types of ships of the U. S. Navy, the new battleships, authorized in the 1916 program and the largest and most powerful in the world, the fleet submarines and the steel airplane carrier ship "Langley," the latter is obviously of first importance to the aeronautical world.

This last vessel is the old collier "Jupiter," remodeled until her original designers could scarcely recognize her. She was launched in 1912 and was as novel then as now for she was the first to be driven by electric turbines of 7152 horsepower. Placed out of commission as a collier on May 24, 1920, she has been re-

fitted at the Norfolk, Va., Navy Yard, for her new role.

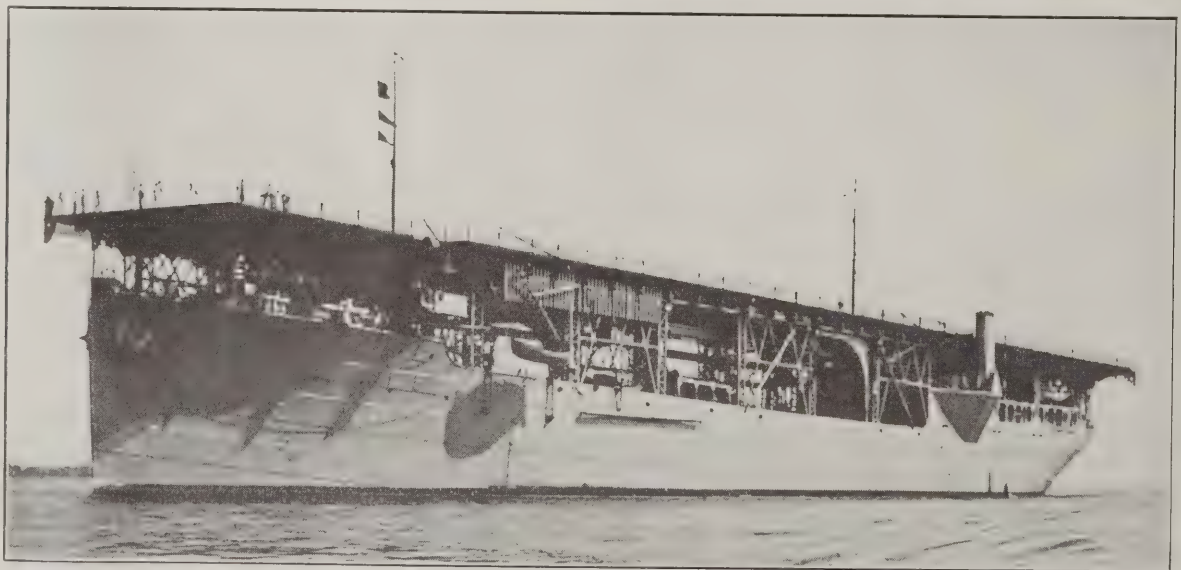
Her present characteristics are as follows:

Length between perpendiculars	520 ft.
Length overall	542 ft.
Beam	65 ft.
Speed about	15 knots
Displacement about	12,700 tons
Corresponding draft about	18 ft. 10.5 ins.
Gasoline capacity	578 tons
Fuel oil capacity	2000 tons

Officers	45
Aircraft mechanics	45
Crew	229
Guns on lower deck, four of 5 inch	
Depth of hold	36 ft. 9 in.

All of the coal handling gear has been removed and in its place has been erected a flying deck, located about 56 feet above the water line, extending from bow to stern, a length of about 525 feet and a width amidships of about 65 feet. This deck is flush all over, and makes an ideal floating aerodrome.

A huge electric elevator, normally flush with the flying deck, 47 feet by 36 feet



The Airplane Carrier Langley

hoists the 'planes from assemblage space on the main deck or from the hold. Forward of the elevator is a "palisade" of channel steel, normally flush with the deck, capable of being raised about 10 ft. up across the deck and on two sides to provide a wind break for protection to the airplanes while being assembled or handled on the flying deck.

Five ton jib cranes, with large outreach, one on each side of the vessel, can hoist seaplanes out of the water and land them on the hangar deck, the deck next below the flying deck. Beneath the flying deck forward and aft of the elevator are electric traveling cranes of five ton capacity provided for hoisting 'planes out of the hold and for transferring them fore and aft to the shop spaces and elevator. Shop facilities for repairing include: machine shop, wing repair shop, molding shop, metal shop, store rooms, blacksmith shop, armory, foundry, torpedo repair shop, photograph laboratory.

While open hangar space is provided between the main and flying decks, hold spaces are arranged for the stowage of aircraft and accessories, aircraft ammunition, fuel oil, gasoline and stores.

Quarters include accommodations for the ship's own complement and the officers and enlisted personnel assigned to the care and operation of the airplanes. In addition to berthing spaces the quarters include hospital, laundry, butcher shop, bread room, general mess pantry, general issuing room, food service room, etc.

Forward of the forward mast is a rapid-rook lookout for the use of officers in charge of operation and control of activities on the flying deck, to note the course of the vessel, give signals and observe the approaching airplanes.

The two 54-foot masts, one each forward and aft, are made to telescope and disappear entirely below the flying deck. These are used for the main or long distance radio antennae, which are quickly stowed when the masts are hoisted. Raising or lowering the masts and antennae is done in the minimum of time. Antennae for short distance communication with shore stations or with other ships are suspended horizontally along the two sides of the ship from booms.

The navigating bridge on the bow will be noticed below the flying-off deck.

An elaborate system of gasoline and oil distribution has been installed. At each side of the ship near the aft mainmast respectively is a gasoline and lubricating oil station. Two of each on either side are provided further forward in close proximity to the palisade. A gas distributing pump is used to distribute the gasoline to four service tanks. At each service tank is a small service pump to further distribute the gasoline to the filling stations which are provided as above. The gasoline and oil to be stowed total 578 and 90 tons respectively. The oil is distributed in a manner similar to that of the gasoline. Provision is made for heating the main oil tanks and service tanks, the latter to a temperature of about 130 degrees F.

A platform for testing airplane engines with propellers in place will accommodate the largest airplane yet contemplated.

In the stern, just under the flying deck, is a pigeon loft and between it and the rear mainmast is a balloon-filling station for use with hydrogen or helium gas compressed in tanks.

The smoke pipes are arranged so as not to obstruct the flying-off deck and to keep smoke clear of the deck. This is

accomplished by providing a short smoke stack on each side clear of the flying deck. The branches are interconnected so that the smoke may be discharged always on the lee side. One of the smoke pipes is arranged to hinge downward when it is considered necessary to discharge the smoke near the water, while the other can discharge the smoke downward through a water spray.

A flooding and sprinkling system is provided for airplane ammunition spaces and especial attention has been given to ventilation. A fire extinguishing system using steam for smothering is also provided for all hold compartments containing airplanes, gasoline tanks and oil tanks and compartments adjacent thereto. A water fire protection system also extends to other positions on the flying-off deck, with fire hose for the fire plugs while additional foam fire extinguishers are also considered necessary.

There are berths for the Captain and 9 officers of the ship, 35 flyer officers and 45 chief petty officers (aviation mechanics) and a crew of 229.

Around the flying-off deck is a rail supporting a life net, which is arranged to hinge down and outboard so that the deck can be readily cleared of all obstructions. This life net may be laid down in sections, clearing a part of the deck at a time, if desired. Portable stanchions and chains surround the elevator well when the elevator is down.

A masthead anemometer is electrically connected to the pilot house, to the flight officers' office or elsewhere. Voice tubes are arranged at suitable points.

Near the mainmast is a radio compass house, arranged to raise up from a position flush with the flying-off deck.

National Aeronautic Association Organized for the Advancement of American Aeronautics

THERE was organized and incorporated at Detroit, Mich., October 12-14, 1922, a new national body by 379 delegates from nine districts of the United States corresponding to the Army Corps Areas, under circumstances vastly more auspicious than any of the earlier efforts at a truly national organization.

It may be remembered that a number of years ago some of the more active members of the Aero Club of America, in co-operation with a number of dissatisfied affiliated clubs, attempted to form a national body, truly national in scope in spirit. This failed through the promotion by the Aero Club itself of an alleged national body, which infant later succumbed to some child's disease.

Just before the War, Howard E. Coffin interested himself in attempting to amalgamate the Aeronautic Society (New York) and the Aero Club of America into an Aeronautical Institute. Factions in the Aero Club at that time, later eliminated, prevented the fulfillment of this idea.

Just after the war, returning pilots formed the American Flying Club in New York which was joined with the Aero Club of America in 1920. In the Fall of 1921, during the flying meet at Omaha, there was formed the National Air Association, with Sidney D. Waldon as President and Rex L. Uden, of Cleveland, as

Secretary.

This was a preliminary attempt to enlist all the aeronautic interests of the country into one big union and it was expected to complete the job at the second congress in 1922. During the ensuing months Colonel H. E. Hartney, secretary of the advance committee, organized an advance committee and, stirred up many cities to the formation of air boards. This advance committee was composed of five hundred enthusiasts, and of these an executive committee of thirty carried on the active work culminating in the convention just held during the flying race meet at Detroit.

It is assumed that eventually the national association would naturally become, in place of the Aero Club of America, the American member of the Federation Aeronautique Internationale. The Aero Club of America, practically since its inception, has been the body officially representing America in world aeronautics through its membership in the F. A. I.

The new Association was incorporated October 14th, 1922, as a non-profit, membership corporation, the papers being dispatched from Detroit to Hartford, Connecticut, by airplane and incorporation completed on the day of adjournment of the Congress. The control is in the hands of 23 governors, of whom each district

is represented by two, with 5 governors-at-large.

Officers elected were as follows: Howard E. Coffin, President, Detroit, Mich., Bernard H. Mulvihill, Vice-President, Pittsburgh, Pa., Benjamin F. Castle, Treasurer, New York City. John B. Coleman, Recording Secretary, Sioux City, Ia. Governors elected, two from each district, were as follows:

1st District
Porter Adams, 3 Commonwealth Ave., Boston, Mass.
Godfrey Cabot, 940 Old South Building, Boston, Mass.

2nd District
John Larkin, Jr. c/o Larkin Company, Buffalo, N. Y.
Maurice Cleary, 729 7th Ave., New York City.

3rd District
L. F. Sevier, Forbes & Craig Streets, Pittsburgh, Pa.

R. J. Walters, 600 Woodbourne Street, Baltimore, Md.

4th District
Van H. Burgin, 217 Healey Building, Atlanta, Ga.

L. Sevier, President Manufacturers Association, Birmingham, Ala.

5th District
Glenn L. Martin, 16800 St. Claire Avenue, Cleveland, Ohio.

Dudley M. Outcault, Traction Building, Cincinnati, Ohio.

6th District

C. S. Rieman, 22 West Monroe Street, Chicago, Illinois.

Sidney D. Waldon, c/o Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

7th District

Ralph Cram, 216 Main Street, Davenport, Ia.

H. F. Wehrle, 503 Railway Exchange, Kansas City, Mo.

8th District

Edgar G. Tobin, 207 Augusta St., San Antonio, Texas.

William F. Long, Stinson Field, San Antonio, Texas.

9th District

P. G. Johnston, 2432 North Broadway, Seattle, Wash.

C. H. Messer, 1803 West 3rd Ave., Spokane, Wash.

Personnel of the National Headquarters has been partially selected and installed in Washington and consists at present of men in charge of Administration, Contests and Foreign Relations, Membership, Finance Legislation and Publicity. Full membership on these various committees is now being selected by the President by and with the advice of the Governors.

Mr. H. E. Hartney has been appointed Acting General Manager.

The purposes of the new Association are briefly as follows:

(a) To maintain in the headquarters of the Association in Washington an agency capable of voicing a vigorous public opinion upon beneficial and essential legislation in all matters of aeronautics;

(b) To awaken and educate the public mind to the possibilities of aeronautics, both as a vital means of national defense and as a transportation factor in the commercial development of our country;

(c) To supply an impartial medium thru which the thought of all sections of the country may be collected, collated and harmonized into a national expression of opinion;

(d) To encourage and promote the study and advancement of the science of aeronautics, and to maintain an institution which will collect and disseminate general and technical data for the development of the industry;

(e) To sanction and actively supervise under license of the Federation Aeronautique International all contests, trials, competitions and other events involving aerial craft or apparatus, and to approve all records in connection therewith.

The Governors of the Aero Club of America and the Governors of the National Air Association, the two largest aeronautical bodies in America, have already voted to merge their membership into the new association and steps are now being taken to have other smaller aero clubs and flying organizations to take similar action.

There are approximately 160 aero clubs about the country.

Thursday Evening, Oct. 12

The first meeting was called to order with H. H. Emmons, president of the Detroit Board of Commerce in the Chair, with Col. H. E. Hartney as Temporary Sec. Mr. Emmons welcomed the visitors to the rooms of the Board of Commerce and to the City of Detroit.

He likened the proposed air association to the National Automobile Chamber of Commerce and told of its need "through

the reckless and improper use of air equipment at the present time."

Mr. W. P. McCracken, of the American Bar Association and a flyer, was elected permanent Chairman of the Convention.

Col. H. E. Hartney was elected permanent Sec. of the Convention.

The nine districts into which the United States is divided by the association were called upon to report their committee members appointed by the districts in caucus, as follows:

Credentials
Resolutions
Legislation
Constitution
Finance
Membership
Nomination
Permanent Rules
District Constitution

Mr. Ruter W. Springer, a Pennsylvanian and a pioneer army chaplain in aeronautics said it had been suggested "that this organization was going to be run by one interest or another. We know that it is not, but in order that the outside world may know that, I offer this resolution:

Mr. Springer reads the resolution which states that the qualifications of all governors and officers in the new association shall be shown on all records.

The resolution to refer it to the committee in By-laws was not seconded.

Mr. Mitchell, of Georgia, invited the association to hold its 1924 meeting in Atlanta. No action taken. Chicago followed with a similar invitation.

D. M. Outcault, of Ohio, was called on to give a short review of the organization of the "National Air Ass'n" at Omaha in 1921, in the absence of its president Sidney D. Waldon, of the Packard Company.

Godfrey L. Cabot, a founder member of the Aero Club of America, told of the early history of this club, and told of the Aero Club's interest in seeing this new association take over the club's former functions which were those of merely a local organization.

Colonel H. E. Hartney, the organizer of the new body, was praised for his work from the Chair and called upon. He responded by crediting H. E. Coffin, V. P. of the Hudson Motor Car Co. of Detroit with being the man "who has 'held the bag' in bringing us all together....."

Founding of American Flying Club

Col. Hartney praised the early work of the Aero Club, told of the formation of the American Flying Club, by the pilots after the war and its amalgamation with the Aero Club. "Things were not quite properly organized and the result was it began to peter out. After a while somebody suggested that we clean up the whole situation and get a new—nationalize the Aero Club of America properly." He followed with an outline of what had been done up to the present by the Advance Committee of the Association.

The announcement was made that a charter had been prepared for incorporation under the laws of the State of Conn. Motion was carried that the chairmen of the nine districts represented at the convention sign the charter as incorporators and forward it to Conn. by airplane for filing so that the Association would be a legal entity before adjourning.

On adjournment for the evening and in the morning of the following day the various committees got to work.

Meeting of Friday, 13th

Committee on Rules and Procedure reported its work in the interim, and an-

nounced its rules of procedure for the meeting, which were adopted.

Membership Committee next reported. Its report was referred to the Com. on Constitution and By-Laws. A feature of the report, was an estimate of possible strength during the first year—19,000 members, by drawing on the Chambers of Commerce, Kiwanis, Lions and Rotary Clubs.

Credential Committee next reported. Three hundred seventy-nine was found to be the number of accredited delegates to the Convention.

Financial Policy

Late Col. B. F. Castle, Chairman of the Finance Committee reported.

He recommended extreme conservatism in the expenditure of funds during the first year, which funds would be derived from membership dues, which were estimated as follows:—

275	Life members	
	@ \$500 and int.	\$6875
735	Sustaining members	
	@ \$50	36850
15400	Regular members	
	@ \$5	77000
—	Organization members	
	@ \$10-\$150	not estimated
—	Air Board Organization	
	members @ \$25-\$150	not estimated
2730	Junior members	
	@ \$2	5460
		\$126,185

Municipal "air boards" may join the Association at from \$25 to \$150 a year according to a sliding population scale.

Of the membership dues, the Committee believed 75 per cent, or \$94,638, should go to National Headquarters, the remainder going to the District Headquarters.

Official Publication

"Another possible source of revenue" considered by the Committee was "an official publication," but the Committee recommended by the Governors take steps to insure a circulation medium for the bulletins of the Association by a connection with some publication already existing, under which there would be neither revenue nor expense.

Estimated expenditures, as figured by the Committee, are as follows:—

Salary of General Manager	\$5000
Expenses (traveling, entertainment)	2000
Office salaries	2600
Organizers expenses	3500
Incidentals	2000
Multigraphing	300
Office Supplies	300
Bills Payable Nov. 1, 1922	1500
Prizes	3000
Reserve	74438.75
Less 50%	37219.37
Total expenditures	57419.38
Plus permanent reserve	37219.37
	\$94,638.75

It was recommended the Governors be permitted to spend 50% of the reserve for expansion work.

The Committee's report was adopted.

Admiral W. F. Fullam, retired, reported as Chairman, Legislative and Policies Committee, to the effect that until the Association was actually formed it was in no position to outline policies or to formulate bills.

Safety Code

Criticism of the 31 members of the committee of the Bureau of Standards and the S. A. E. engaged in planning a safety code was made parenthetically at

this point. "This safety code is being prepared by a body which is in no way representative of aeronautics," it was claimed by a delegate. "Twenty-five members are selected from government bodies, research organizations, that are not connected with the manufacture, or operation of either aircraft, equipment or their accessories."

Mr. William J. Hammer chairman, a pioneer in the Electrical world and an expert in aeronautics, and Ruter W. Springer, Sec., reported for the Resolutions Committee. These resolutions covered the following subjects:

National policy (carried).

Urging of federal legislation for regulation civil aeronautics (carried)

Licenses for pilots (resolution laid on table)

Disapproval of Hull bill (H. R. 10967) providing for aeronautic material to be constructed in government plants. (Tabled as too drastic at this time). Endorsement of plan by which civilian contractors carry the mails. (carried).

Appreciation of the remarkable achievements of the U. S. Air Mail by the Post Office Department. (carried).

Appointment of Committee on Aeronautical Meteorology in the Association (Tabled).

Urging of Congress to make adequate appropriations for experimentation and development for military and naval aeronautics. (carried).

Committee on Constitution and By-Laws

reported through Dudley M. Outcalt of Cincinnati, Constitution and By-laws were read through paragraph by paragraph and adopted. Copies of these may be had upon application to the headquarters of the Association.

"Hazardous Flying"

After a discussion of a resolution putting the Association on record against wing walking and similar useless exhibition stunts, the general idea was approved in a motion.

Motion that its various engineering societies be requested to lend their active support to the work of the National Aeronautic Association was carried.

Motion thanking the Mayor of Detroit for the hospitality of the city was carried. A similar one was approved with respect to the Chamber of Commerce and the Detroit Aviation Society.

Other motions of similar nature were passed respecting the War Department, Navy Dept., Marine Corps, Post Office, Department of Commerce, N. A. C. A. State Police, and the Advance Committee on Organization, especially ex-Colonel Hartney, Sec. pro tem.

Mr. G. A. Shoemaker reported for Com. on District Constitution and By-laws in which it was recommended the districts be given the greatest powers of self government, their Constitutions and by-laws to be submitted to the Board of Governors of the national body for approval before adoption. (Carried).

Floyd J. Logan presented a number of practical suggestions for contests in 1923.

James A. Meissner, ex-major in the Air Service, an "ace", offered a resolution urging the Association exert every

effort to stimulate organization of National Guard squadrons. (Carried).

Officers

John B. Coleman, of Sioux City, Ia., spoke for the Committee on Nominations and reported the candidates following were elected:

Howard E. Coffin, Detroit, Pres.

Barney H. Mulvihill, Pittsburgh, Pa., Vice-President.

Benj. F. Castle, New York, Treas.

John B. Coleman, Sioux City, Ia., Recording Sec.

Nominations for two members for the Board of Governors, one of which is to be designated as the District Vice President, were next in order and presented as previously mentioned.

After considerable discussion of Glenn Martin the nominations were passed. Mr. A. M. Harris of Cleveland, while expressing the highest regard for Martin, believed the members of the convention "will agree that it is not the thing to put any flavor of a manufacturer or aircraft corporation on to the results of this convention. There are a lot of people throughout the United States affiliated with outer organizations who have it decided in for the manufacturer or aircraft organizations.....I believe the people at large consider him (Martin) a member of the Manufacturers Aircraft Ass'n.....and I think the effect on this result from this convention would not be what we would all desire it to be.....I think the best interests of Aeronautics would be best served by Mr. Martin not serving as a governor in the beginning of this Association. I thank you!"

The convention then adjourned.

N.A.C.A. Multiple Manometer

JUST what an airplane does in free flight, the degree of its stability or instability along its three axes; the position of the ailerons, elevator or rudder during any maneuver, such as a loop, spin, turn, landing or take-off; the force necessary in operating controls; the forces acting on controls in maneuvers; examination and recording of the air flow; the illustration of the properties of airplanes and the visualization of their behavior; the demonstration of the stresses undergone by an airplane in straight and acrobatic flight and how long these stresses last; and the visualization, comparison and measurement of the ability of pilots, all are recorded photographically by the instruments developed by the technical staff of the National Advisory Committee for Aeronautics. Following is the first of a series on these new instruments.

The latest of the series of novel and revealing recording instruments of the National Advisory Committee for Aeronautics for aircraft in flight maneuvers is the Multiple Manometer, which records simultaneously on a photographic film pressures at 30 different points on wing, tail, or aileron surfalls.

The instrument is placed in the observer's cockpit (Fig. 3) of a two-seater. From 60 openings 60 tubes lead to 30 capsules inserted in the two sides of the surface to be tested. The Control position recorder and the accelerometer are in operation simultaneously with the manometer.

*For complete reports on pressure dis-

tribution, obtain Nos. 118, 148, 149.

With this instrument it is possible to record pressures up to plus or minus 45 lbs. per sq. ft. for a period up to 75 secs. with the present adjustment of the capsules. Thirty differential pressures can be recorded simultaneously by this apparatus.

The principal part of the device consists of 30 separate pressure "capsules" Fig. 1 and 2. arranged around the outside of a cylindrical aluminum casting, in three rows of ten. At the center of the bottom of the case is an electric bulb with a

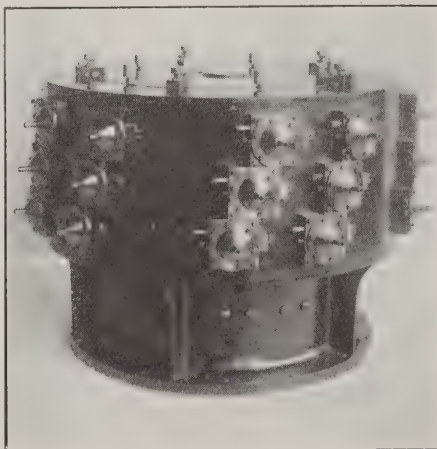


Fig. 1.

straight vertical filament. This bulb is enclosed in a chamber having a horizontal annular slit .004 inches in width so that a horizontal sheet of light is spread out in all directions. This light is intercepted when it reaches the inside of the case by 10 long prisms which send it directly upward to 30 small prisms, which, in turn, transmit the light through lenses to a small mirror on each capsule. The beam of light is then finally reflected back through the same lens, which focuses it sharply on a film.

This film has a width of 4½ inches and is wound on a drum 6 inches in diameter. The film is mounted in a light tight case which can be lowered inside of the instrument between the rows of prisms and the driving mechanism. A rotary shutter opens 30 slits for the entrance of the light beam after the film drum is in place.

The film drum is turned through 1/10th revolution by a constant speed electric motor driving through a double worm reduction gear. The speed is regulated by a centrifugal governor with electric contacts which cut in and out a resistance. The speed remains constant within one per cent for considerable changes of either voltage or load.

The pressure capsule consists of a brass case divided into two chambers by a hard brass diaphragm with a connection for pressure in either part. The movement of the diaphragm rotates a small plain mirror which is mounted on pivots and in this

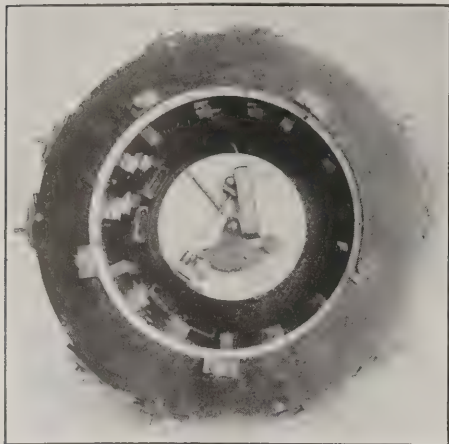


Fig. 2.

manner causes the light beam to move over the film and give the record. The moving system of the capsule is sufficiently light and well balanced to prevent any acceleration from affecting the pressure readings.

Operation

To make a record, tubes are connected to the capsules in such a manner that the pressure side is connected to the back of the capsule and the corresponding suction tube to the side of the capsule. To operate the driving motor and lamp a source of 8 volts d. c. is required. Binding posts for the driving motor and for the lamp are on the outside of the instrument. A suitable switch is conveniently placed so that the pilot may start the record at any desired instant. When the drum is in place and the shutter is opened the in-

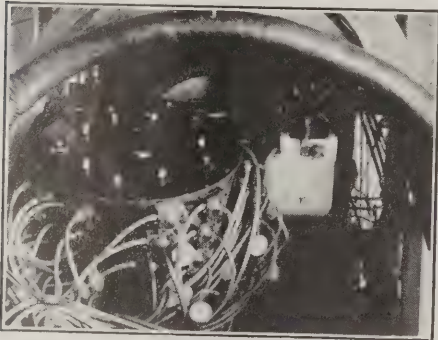


Fig. 3.

strument is ready to operate by closing the switch.

The film drum is loaded in a dark room with a fast bromide paper, or its equivalent, with the sensitized part toward the outside. The shutter is closed when the drum is out of the instrument and only opened when ready for the run.

If a longer record is desired, the drum can be made to move at slower speed, by tightening the spring on the governor a slight amount. If a much larger change is desired, stiffer springs may be substituted. The drum speed can also be changed by changing the driving gears.

Pressures on Rudder and Fin

Using the manometer, an investigation has been made by the N.A.C.A. of the pressure distribution over the rudder and fin of a J N 4H in straight flight and in acrobatics (Report No. 149).

The results obtained from this investigation enable designers to know much more closely than hitherto the nature and magnitude of the loads acting on the rudder and fin of an airplane. Contrary to previous beliefs, the loading on the vertical surfaces is generally greater than on the horizontal ones.

It is recommended that in sand-load tests a unit load of 2 pounds per square foot be used, this unit being multiplied by the designed load factor of the wings to give the maximum load on the rudder and fin. The center of gravity of the load may be taken vertically at the same level as the center of gravity of the area, while the fore and aft distribution should be as shown in Figure 10. Care should be taken in all designs to make the leading edge of the fin stiff, as it is believed that nearly all tail surface failures are due to vibration.

Elevator and Stabilizer Pressures

Another series of tests was made, recording pressures on the horizontal tail surfaces (Report No. 148) in spins, dives, etc.

The results of these tests show that tail loads can not be computed from model tests. This is due to the fact that the airplane begins to rotate as soon as the elevator begins to be pulled up, thus relieving the load before it can build up. The tail load necessary to produce an angular acceleration is small compared with that necessary to balance the pitching moment of the wings.

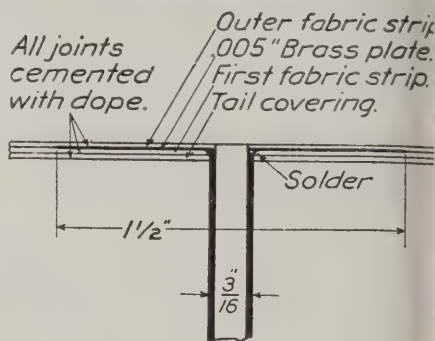
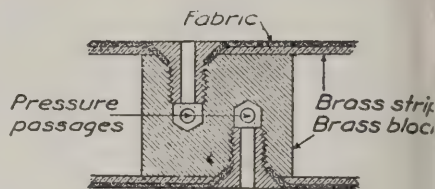


Fig. 4.

The method of calculation based on the wing pitching moments and the angular acceleration gives the tail loads closely in any maneuver where the speed, normal and angular acceleration, and center of gravity position are approximately known.

It seems evident from these tests that the strength of fuselage and tail surfaces on the present machines is excessive, and that a considerable saving in weight can be made.

Pressures on the Wing

Hills and valleys of pressures are shown by the photograph (Fig. 5) of a built-up model illustrating the varying pressures on a square-tip wing. A "map" of the same outer section of a wing shows by contour lines the various pressure differences over the surface (Fig. 6).

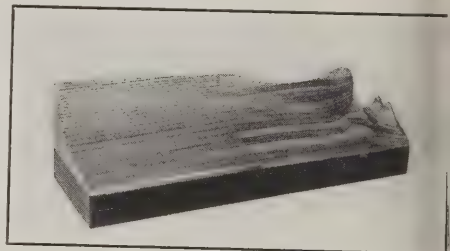


Fig. 5.

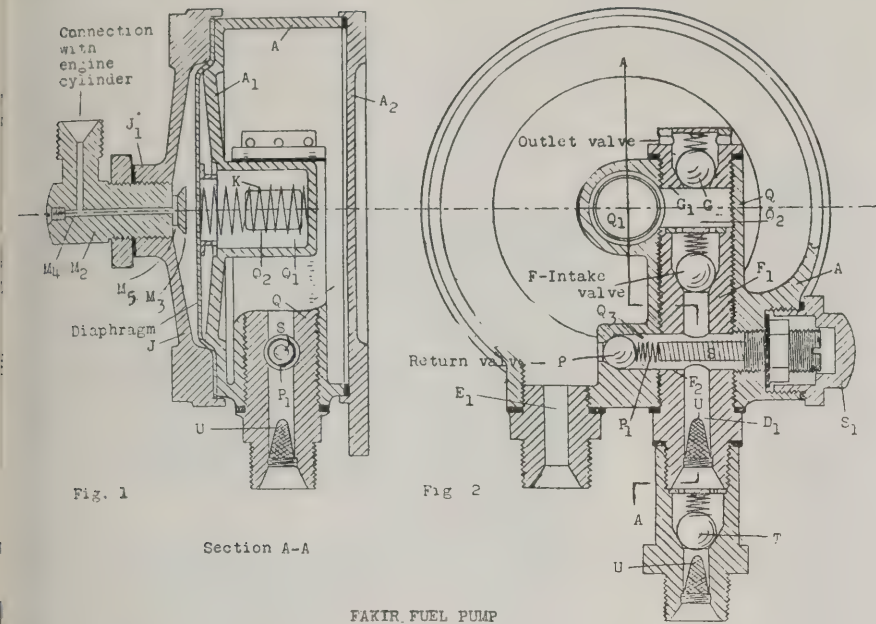
Fakir Fuel Pump

IN DESIGNING the Fakir fuel pump, the fundamental idea was to obtain a simple and reliable method of conveying the fuel from a low tank to the carburetor, with the avoidance of the faults of all former methods and the simultaneous warming of the fuel by means of the heat of compression generated.

The principle of the Fakir fuel pump rests on the well-known principle of the diaphragm pump, which must however be suitably adapted to the present purpose. Figs. 1 and 2 are drawings of the pump. Inside the housing (formed by the circular wall A, the front wall A₁, and the rear wall A₂), there is a hollow body Q cast in one piece with walls A and A₁, con-

taining the inter-connected horizontal and a vertical channel Q₁ and Q₂. The channel Q₁ is open toward the diaphragm and contains the spring K which presses against the diaphragm. The channel Q₂ is connected with the inlet D₁ and above into the pump housing. The intake valve F and the pressure valve G are respectively below and above the channel Q₁. The seats of these valves are shaped out of the tube connections F₁ and G₁ which communicate with the channel Q₂. The hollow body Q also contains a second horizontal channel Q₃, which lies below the intake valve F and forms a connection between the vertical channel Q₂ and the space inside the pump housing through the return valve P

(for the back flow). The latter is held shut by a spring P₁ which is coiled about a bolt S. The bolt and spring lie in a cross bore F₂ of the tube F₁. The bolt S is screwed into the wall A and its outer end is covered by a screw cap S₁. Below the return valve, there is a non-return or check valve T which, like the inlet valve, is provided with a strainer to keep out any dirt there may be in the fuel. The diaphragm lies between the wall A and the cover J which is clamped on to a special shaped base. This base, which is formed by the wall A₁, is so made that the diaphragm can only yield within suitable limits, without danger or rupture or fatigue, and is then supported by the base so



that the high cylinder pressure cannot hurt it. The distance of oscillation in either direction and the pressure of the diaphragm spring have been adjusted by many experiments, so as to come within the elasticity of the metal diaphragm and prevent the possibility of fatigue. For the protection of the diaphragm from the spring, there is a pressure plate on the end of the latter. The gas-pressure space, inclosed between the diaphragm and the cover, is (through the elbow M_2 and the channel M_4 , which opens into the gas space through the cross channel M_5) in direct communication with the engine cylinder.

The Fakir fuel pump operates as follows: The pressure variations in the engine cylinder produce oscillations of the diaphragm. During the period of dimin-

ished pressure in the engine cylinder, the oscillation of the diaphragm (supported by the force of the spring behind it) draws fuel from the tank, which is then (during the period of compression, explosion and exhaust) driven out again. This process, which is continuously repeated all the time the engine is running, pumps considerably more fuel than the engine requires. The excess fuel must therefore be rendered harmless. This is accomplished by the automatic flow of the excess fuel (which does not run through the outlet E_1 to the carburetor) back through the return valve P into the fuel column under the intake valve F . In order to prevent this action from causing any return flow of the fuel column into the fuel tank, the check valve T is introduced. The pump

therefore always delivers to the carburetor only the quantity of fuel required at the time by the engine, while the excess fuel circulates inside the pump. Now, since heat is produced by compression, this circulating fuel is highly heated by coming in contact with the thin metal diaphragm. The fuel is still further heated by the heat conduction of the metal pipe connecting the pump with the engine cylinder, in which pipe hot gases, oil and other fluid residues of the explosions oscillate to and fro. After the engine has been running a short time, these fluid residues fill up the gas space (between the diaphragm and over J) and parts of the delivery pipe, so that, in practice, no increase in the volume of the clearance space takes place in the engine. By suitably adjusting the size and length of the delivery tube from the pump to the engine cylinder, it is possible (within certain limits) to give the fuel any desired amount of preliminary heating and, even for low initial temperatures of the fuel in the tank, obtain final temperatures of 30-35°C in the float chamber of the carburetor. Experience has shown that engines with fuel warmed in this manner can use cold air even in winter and still develop a high degree of efficiency, as well as be able to utilize difficultly volatile fuel.

The Fakir fuel pump can be installed anywhere between the fuel tank and the carburetor, since the flow of fuel to the pump does not depend on gravity, but on adjustable pressure. It may be further said that it is proof against all shocks and changes of inclination on motor vehicles of all kinds (including water and air craft), since it has no movable parts aside from the four valve balls which are held by springs. The chances of its getting out of order are therefore reduced to a minimum. It requires no attention, aside from seeing that the piping is tight, which is an essential condition for any pump.

Paragon Adjustable and Reversible Propeller

THE Paragon adjustable and reversible aircraft propeller, the invention of Spencer Heath, the pioneer propeller maker, made its official debut on October 11 at Bolling Field in a demonstration to representatives of the offices of the Chief of Air Service, Chief of the Bureau of Aeronautics of the Navy, of the Air Mail, the Press and motion picture news associations.

The automobile truck trailer, upon which the propeller and a 150 h. p. Wright-Hispano engine was mounted, was made to maneuver about Bolling Field at the will of the operator.

What new stunts may now be evolved with the aid of a reversing propeller may be left to the imagination. One can easily imagine the two-seater of the future suddenly reversing into a stall and taking a shot from underneath at his surprised adversary overhead. The device is to the aircraft what change speed gears are to the automobile.

It comprises, in short, a system of special blades and a mechanism for varying the pitch of the blades from zero to 360 degrees, while in flight or otherwise. The invention is being marketed by Paragon Engineers, Inc., 243 E. Hamburg

St., Baltimore, Md.

By adjusting the pitch, either before starting or while the engine is running, to a less than normal angle, the engine is allowed to pick up speed and deliver its maximum power which is necessary in taking-off with a heavier load than the same airplane could otherwise normally carry. Upon reaching the desired altitude, the pitch may be increased by the pressure of a finger on a knob on the dash and the engine run at its most economical speed, still with the possibility of increased speed range should occasion demand. As the load is lessened by consumption of gasoline on a long distanced flight, the pitch may be still further increased.

In landing, the pitch of the screw may be changed to any degree in the opposite direction, or "reversed" just before the instant of contact with the ground and the plane brought to a stop in the very shortest space, obviating entirely any prepared ground system of slowing up the machine.

This is a feature of especial moment to naval aeronautics where the shortest run after landing is a prime necessity, owing to the confined space which may be available on a ship's deck or even on that of an airplane carrier ship, like the "Langley."

For the airship, the same advantages of economy are apparent while the reversible attribute exactly doubles maneuverability in docking, whether shed or mooring mast is employed.

It is even possible that the adjustable and reversible propeller may cause rapid advancement in the helicopter, or direct-lift, machine.

It was long realized that the variable pitch and reversible propeller was a development which would travel side by side with supercharged and multi-engined aircraft.

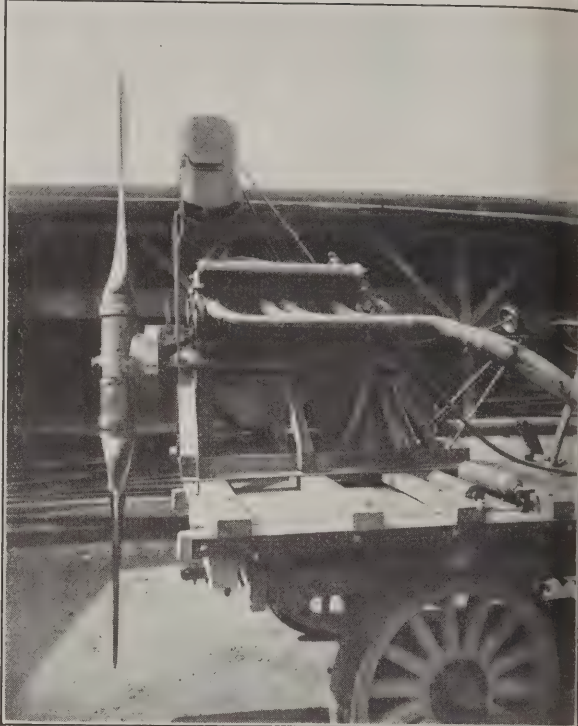
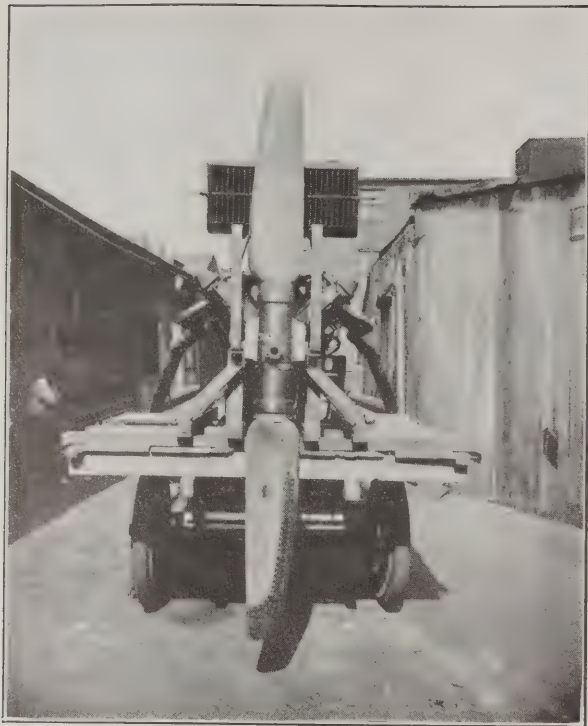
This new design now avoids the objectionable features ordinarily considered with respect to possibilities in this direction.

In the Heath propeller there has been achieved:

(a.) Elimination of continuously running gears, collars or bearings in the pitch control mechanism.

(b.) The use in flight of engine power in place of manual labor in changing the blade angle.

(c.) The absence of any structural limitation to the range of blade angles available as well as the limiting of the blade travel between any two predetermined extreme positions.



(d.) Continuous indication on the instrument board of the blade position.

(e.) Automatic throttling of the engine while the propeller is passing through the position of neutral pitch.

General Description of Propeller

The two wooden or steel blades are fastened into steel sleeves which in turn

are held in a steel hub, the centrifugal forces being taken on ball thrusts and torsional and axial forces on plain bearings.

The method of fixing the wooden blades into the steel sleeves is noteworthy. The butt end of each blade is tapered outwardly at a small angle as shown in Fig. 1, and the surrounding collar is split so that it may be first sprung over the butt and then compressed upon the taper.

Pitch Changing Mechanism

The pitch changing mechanism is operated through the application of a braking force to either one of a pair of small brake drums surrounding the engine crankshaft and normally rotating with it. The elementary principle is shown by diagram in Fig. 2, which represents a brake drum connected through a gear train to the individual blades of the propeller

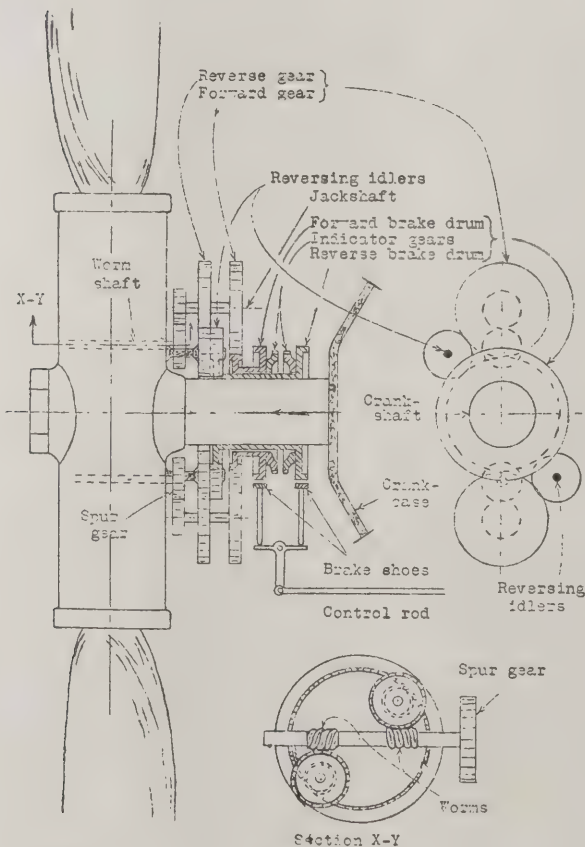


Fig. 3. Pitch changing gear train.

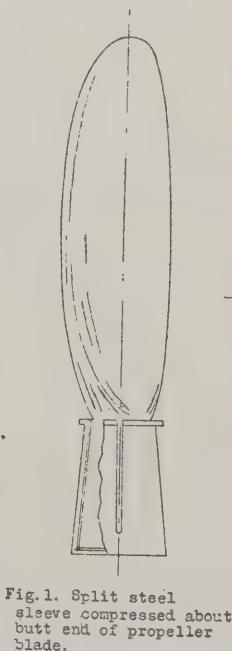


Fig. 1. Split steel sleeve compressed about butt end of propeller blade.

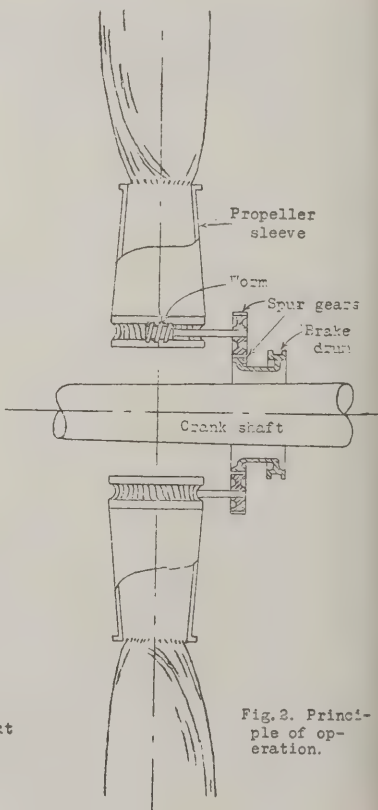


Fig. 2. Principle of operation.

to revolve at crankshaft speed, all the gears will be stationary relative to the propeller and that the pitch angle will remain constant. If, on the contrary, the brake drum is held stationary the gear train will be set into action and the pitch angle of the blade will undergo a continuous change until the brake drum is released.

In order to change the blade angle in the reverse direction a second brake drum is used, connecting to the worm shaft through an idler which serves to reverse the direction of rotation of the worm shaft. It should be noted that during normal flying none of these gears are operative and that the blades are locked in position by the non-reversible features of the worm and the friction of the connected parts.

The actual construction of the pitch changing mechanism is more fully indicated in Fig. 3. The brakes are applied through leather faced shoes operated from the pilot's seat by a light push and pull knob attaching to a brake lever mounted on the drum housing. A small hand crank is provided by which the pitch can be changed while the engine is not running.

Blade Position Indicator

The angular setting of the propeller blades at any instant is a function of the relative motion which has taken place between the two brake drums. The indicating mechanism is therefore operated by gearing from the two brake drums which conveys differential motion to the indicating pointer and the throttling and pitch limiting cams. As long as the two brake drums revolve both at crankshaft speed the indicating hand remains stationary but if either of them is retarded an angular motion is shown on the indicator equal to that experienced by the blades themselves.

Automatic Throttle Control

The mechanical throttle is provided with springs in both directions so that the pilot can at any time by applying a force on the throttle greater than the initial tension in the springs substitute manual for automatic control.

Pitch Limiting Mechanism

In the pitch limiting mechanism the control knob normally connects to the brake levers direct, a push increasing and a pull

decreasing the pitch. If the control button is held in either operating position until the limiting position of the propeller blade is reached the cam trips a latch plate and renders the control inoperative in that direction while leaving it ready for use in reversing the direction of propeller blade motion.

Demonstration Under Power

To show the action under power the propeller has been installed on a 150 HP. Hispano-Suiza engine mounted with gasoline tank, observers' seats, etc., on a trailer truck weighing about two tons which is free to roll on the ground. In the demonstrations thus far made the device is put through its entire range of performance, which includes disconnecting the pitch limiting mechanism so that the blade angles are controlled throughout a complete revolution of 360 degrees, both forward and reverse.

With the engine turning at 1500 r. p. m., the angular change from full speed ahead to full speed astern is accomplished in about 3-1/3 seconds.

Navy's Aerial Lighthouse

AN ACETYLENE gas aerial light house has recently been installed by the Navy at the air station at Hampton Roads, Va., and another has been ordered by the Army Air Service for observation at McCook Field. It is not improbable that a line of these may be established on the "model airway" between Washington and Dayton, at the terminals and on the highest ridges in Cumberland, Md., Pt. Marion, Pa., Mounts-ville, W. Va., Zalesville and Columbus, the vicinity of Charlestown, W. V., Ohio.

The Post Office is also interested in a system of lighthouses for the step between Chicago and Cheyenne and another prospect is with the Forest Service.

The Aeronautical light of the American

Gasaccumulator Co., as bought by the Navy and Army is a mantle light with flasher of the type similar to the same make already in service at the Croydon aerodrome in England, where the light has, in that latitude, an average visibility of 32 miles horizontally and from 2 to 4 miles vertically, but more powerful.

These lights are entirely automatic in operation. They may be placed in almost any inaccessible position which may be the most suitable from a navigational point of view and then left unattended for periods up to 12 months, if desired. The flashing apparatus can be adjusted to give any desired grouping of flashes. When

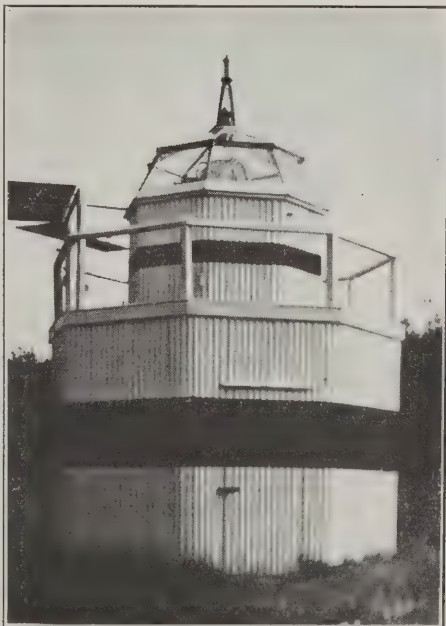
desired, the lights may be fitted with a "Sun valve," which lights and extinguishes the beacon automatically at darkness and dawn from a pilot light which keeps burning.

The optical elements are divided into two sections. The top section consists of half a dioptic drum lens and serves the purpose of projecting a very powerful light slightly above the horizontal plane. The lower elements are catadioptric rings, so arranged as to distribute the light falling upon them at suitable angles above the horizontal plane.

An aviator approaching the light at an altitude not exceeding 8000 feet remains within the area covered by the main beam until he is within about 8 miles of the light. At that range the light source



A. G. A. Light used at Croydon, England.



The A. G. A. Lighthouse at Croydon.



The Aerial Lighthouse at Hampton Roads, Virginia.

itself is easily discernible. The flashing can be adjusted to give any variation of light and dark periods.

It is argued that existing marine light-houses and beacons are so designed that the arrangements of optics in them is such as to give a light of maximum power in certain closely defined directions, only, and the vertical angle of dispersion of the light is generally such that it will only be visible to an aircraft pilot through a very small area and at a long distance from the light.

For night flying it is desirable to have a light clearly visible within its range from any point in the upper atmosphere and, in addition, it must have a perfectly clear and precise light character. It is urged that a light signal must be completely repeated not less than from 6 to 10 times while a pilot is approaching it from a distance of 15 miles. At 90 m.p.h., this distance would be covered in 10 minutes and, therefore, a signal having a total period of 35 seconds will be repeated 17 times. In smaller sizes these lights can be furnished in portable form.

A beacon of the searchlight type, and portable, has been developed by the



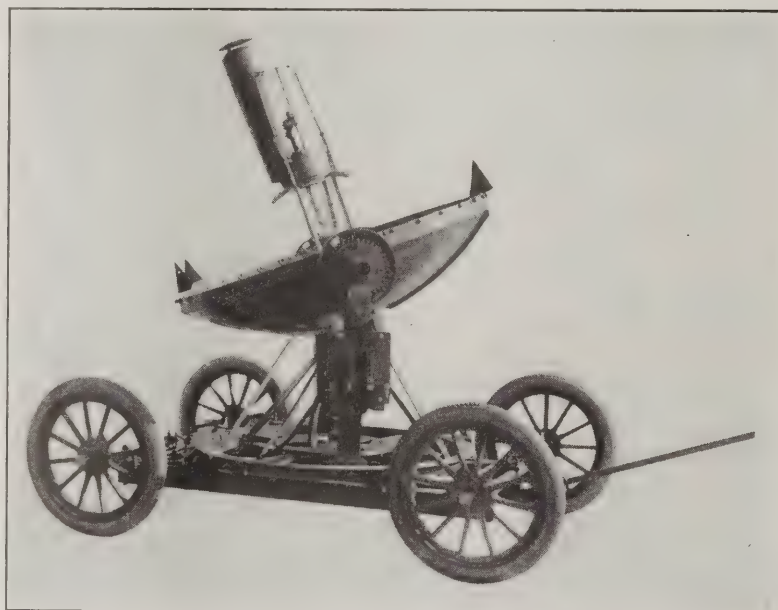
The Sperry Portable Power Unit

Sperry Gyroscope Co. The searchlights which may be of 36" or 44" drum type, high intensity, or 60" open type, are mounted on mobile carriages. An auto-

mobile truck contains the power unit for operation in the field.

In a recent series of tests, one run was made from Brooklyn, N. Y., to the Army's experiment station at McCook Field, Dayton, O., 697 miles.

On the night trip of the Army non-rigid C2 from Washington to New York and return to Aberdeen, in August last the Army airship pilots were given their first experience with the night operation of airships with the aid of high power ground lighting. A Sperry searchlight was stationed in New York harbor and during the period of the flight swept the sky in a circle at an angle of about 15 degrees from the horizon. The heavy fog which obscured all the lights of the city from the circling airship 500 feet above Miss Liberty was penetrated by the searchlight's beams which were seen after leaving New York on the return trip until the ship had passed out of Upper New York Bay. It is believed that such a beam can be seen 20 miles in all weather and 75 or 100 miles without a fog, from as low an altitude as 1,000 feet. The rays of such a light are blinding when near, but the aircraft pilot is easily able to see buildings or other landmarks when flashed upon, from considerable distances.



The Sperry Portable Searchlight

The Prediction of Propeller Characteristics from the Blade Element Analysis

By William H. Miller, M. Sa., Curtiss Aeroplane & Motion Corporation

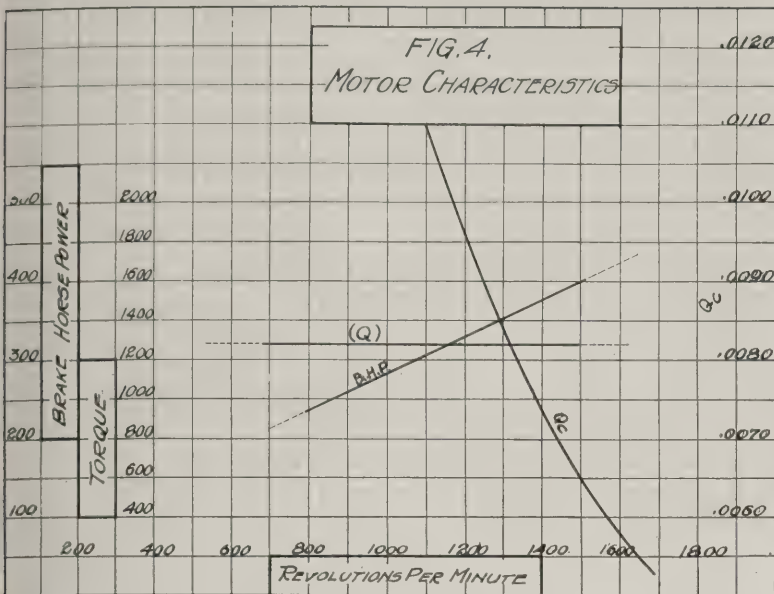
Continued from October issue

IT SHOULD be borne in mind that the formulas established for the approximate determination of the slip angle of the propulsive airscrew should not be applied to standing thrust conditions. For

the static case, θ is in general of such magnitude that the equation

$$\frac{1}{2} m C_L = \frac{\sin \theta \tan \theta}{1 - \tan \theta \tan \gamma}$$

must be solved. This is usually impossible unless $\tan \gamma$ and C_L are expressed as functions of the angle of attack. (For example, C_L and C_D may be expressed, approximately, by linear and quadratic functions of the angle of attack.) Even



Thus one can find the corresponding values of n and J from the propeller torque coefficient curve and the re-plotted motor torque curve. Multiplying the value of J thus obtained by the corresponding value of (nD) we obtain V . Again having given the efficiency, η , of the propeller as a function of J , we know the corresponding values of n and J , and P_m from the motor and propeller curves. Then multiplying this value of P_m by η , we obtain the useful power P_u . The following performance curves of the engine propeller group may then be plotted:

1. Brake H.P. vs. velocity of advance.
2. Useful " " " " "
3. Revolutions " " " "
4. Prop. Efficiency " " " "

One important point in conjunction with design must be noted: It is necessary to estimate, on first trial, the maximum blade width as accurately as possible in order that, for a given planform, the computed brake power will come out within a few percent of the desired power to be ab-

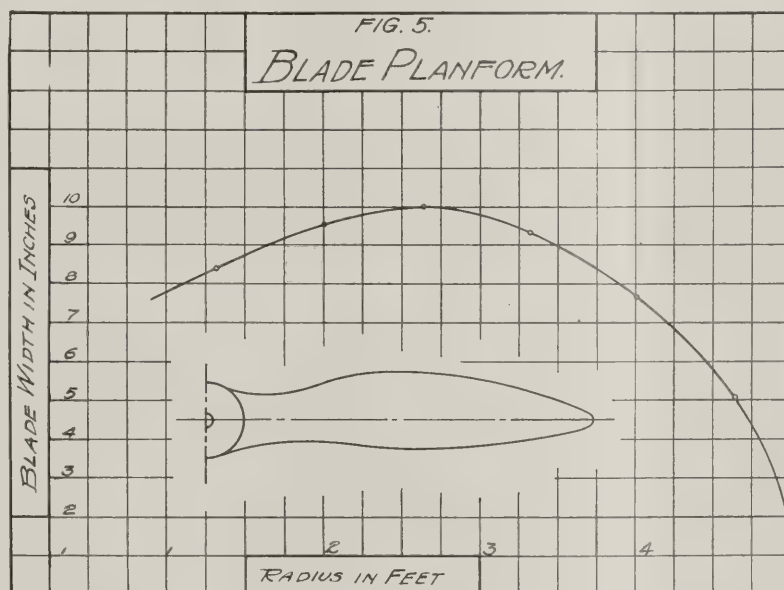
When the solution must be performed graphically. It has been the experience of the writer in designing wind tunnel propellers, that the approximation

$\frac{1}{2} m C_L = \sin \theta \tan \theta$ can be used. The general method of designing a wind tunnel fan will be made the subject of a later article.

Before beginning the solution of a problem illustrating the use of the formulas obtained thus far, we will state, briefly, the usual method of combining the engine and propeller characteristics. If we have given the engine characteristics, torque and brake horsepower versus revolutions, and the propeller curves, thrust and torque coefficients versus J , the procedure is as follows: Reduce the engine and propeller data to the same units. Then replot the engine torque curve as

$$\frac{Q_m}{\rho n^2 D^5} \text{ versus } n$$
 or the particular value of ρ considered. Since the motor and propeller torques are equal

$$\frac{Q_m}{\rho n^2 D^5} = \frac{Q}{\rho n^2 D^5} = \frac{Q_c}{\rho n^2 D^5}$$



sorbed. This is due to the fact that the required blade angle (being a function of the slip angle θ) is a function of the blade width, since the formulas for θ contain

$$\text{the breadth ratio, } m = \frac{Nc}{2\pi r}.$$

Numerical Example.

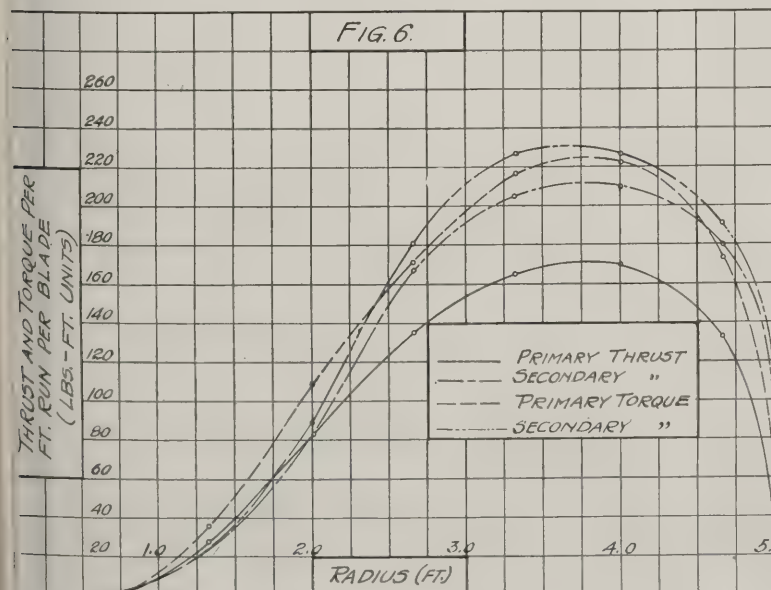
- Primary Data:—
Brake horsepower: 400
Standard Density (.07608 lbs./cu. ft.)
Velocity 120 m.p.h.
Revolutions per minute: 1700
Diameter: 10 ft.
Angle of attack 1° .

The motor characteristics over the working range are given in Fig. 4. On the same sheet is plotted the curve

$$\frac{Q_m}{\rho n^2 D^5} \text{ versus } n$$

$$.07608 \times n^2 \times D^5$$

The blade planform is shown in Fig. 5, and the section thickness ratios and aerodynamic characteristics, together with the detailed evaluation of the thrust and torque differentials for primary conditions are given in Table III, and Fig. 6. Integration of the thrust and torque curves for primary



conditions gave

B.H.P. = 401 $Q_{c1} = .00650$

U.H.P. = 300

Eff. = 75% (approx.) $T_{c1} = .049$

The detailed evaluation of thrust and torque for secondary conditions is given in Table IV and Fig. 6. Secondary conditions gave the following values; for $V = 100$ ft./sec., and $n = 25$ rev./sec.,

B.H.P. = 350 $Q_{c2} = .00827$

U.H.P. = 202

Eff. = 58% $T_{c2} = .075$

Formulas (8) then gave for the constants a, b, c, and d in the equations of the characteristics of the propeller:

$a = .09360$ $b = .1160$

$c = .00892$ $d = .0101$

The propeller thrust and torque coefficients may therefore be expressed by the following equations:

$T_c = .0936 - .116 J^2$

$Q_c = .00892 - .0101 J^3$

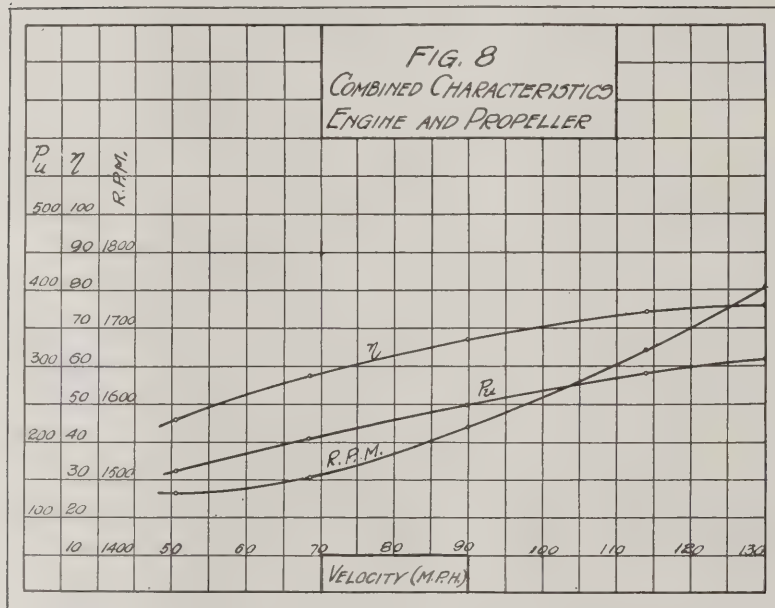
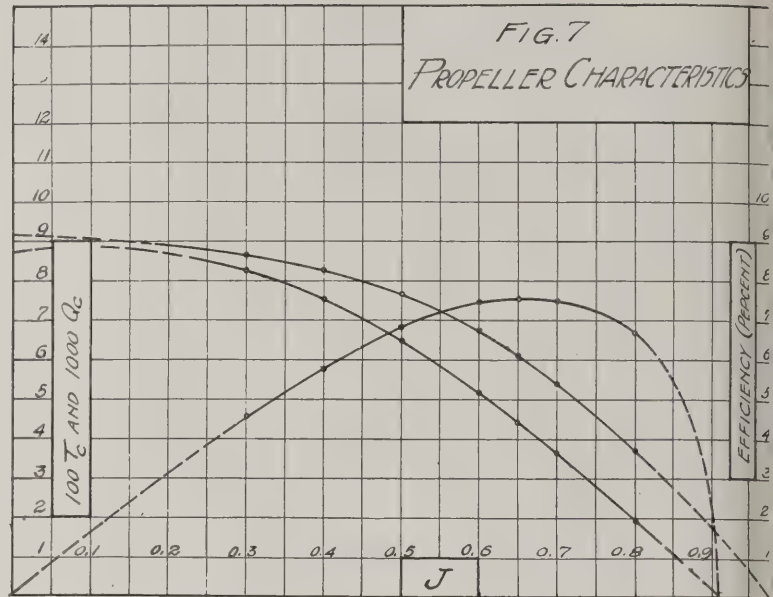


TABLE III

Evaluation of Thrust and Torque for Primary Conditions :

Station	1	2	3	4	5	6
Radius.....	1.33'	2.00'	2.67'	3.33'	4.00'	4.67'
2 — r.n.....	.236	.356	.475	.591	.711	.830
tan ϕ.....	.746	.495	.371	.298	.247	.212
c.os ϕ.....	.8016	.8962	.9376	.9583	.9709	.9767
ϕ	36° 42'	26° 20'	20° 21'	16° 36'	13° 52'	11° 58'
c.....	.700	.792	.835	.775	.635	.421
m.....	.167	.126	.099	.074	.050	.029
CL.....	.275	.340	.300	.255	.220	.193
L/D.....	10.50	15.00	17.00	18.20	19.23	20.20
—.....	5° 26'	3° 49'	3° 22'	3° 9'	2° 59'	2° 50'
O.....	2° 7'	2° 34'	2° 14'	1° 45'	1° 13'	0° 44'
Z'.....	38° 50'	28° 54'	22° 35'	18° 21'	15° 5'	12° 42'
tan ϕ.....	.8050	.5520	.4159	.3317	.2695	.2254
sin ϕ.....	.6271	.4833	.3840	.3148	.20.02	21.98
$Q' + J$	44° 15'	32° 43'	25° 57'	21° 30'	18° 4'	15° 33'
tan ($\phi' + J$).....	.9747	.6424	.4867	.3939	.3262	.2783
cos ($\phi' + J$).....	.7161	.8414	.8992	.9304	.9507	.9634
$V(1 + \frac{1}{2}a)$	184	191	194	194	191	186
aV.....	16	30	36	36	30	20
2 — r.n b.....	15.5	19.3	17.5	14.2	9.8	5.5
D.....	39.8°	29.9°	23.6°	19.4°	16.1°	13.7°
dT/dr.....	28.0	84.5	136.0	165.0	170.0	133.0
dQ/dR.....	36.2	109.0	172.0	216.0	222.0	173.0

The propeller efficiency was found by means of formula (9) and plotted with T_c and Q_c against J in Fig. 7. The steps in the evaluation of the useful power are given in Fig. 8, where it is seen that the maximum efficiency, 76%, occurs at about 130 m.p.h., outside the working range. The latter point is interesting to note. The advance ratio prescribed by the primary conditions may not in general give the highest efficiency it is possible to attain with the propeller. However, once the characteristics of a family of similar propellers have been found, one can apply similitude laws to determine the optimum diameter for given conditions.

Conclusions.

While it appears that the working characteristics of a propeller can be predicted to a fair degree of accuracy by means of the conventional blade element method, as developed fundamentally by Drzewiecki, Riach, Both, and others, the theory will never be exact so long as uncorrected airfoil characteristics, as determined in the wind tunnel, are applied in practice. The vortex theory offers at present the greatest possibilities as regards the development of a really accurate method.

The present article was prepared primarily for the interest of those who desire a simple method of approximating the characteristics of an airscrew over the working range.

(See page 598 for table IV and table V)

Standardization and Aerodynamics

By William Knight, M. E.

ON JUNE 20th, 1921, I published an article in the AERIAL AGE under the title "Standardization and Aerodynamics" in which the suggestion was made of the desirability of calling a Congress of representatives of leading aerodynamic laboratories, without any discrimination between former allies and former enemies, for the purpose of arriving at an understanding as to the coordination of laboratory work in aerodynamics leading to a better utilization of Scientific research knowledge in aeronautics in the interest of all concerned in this matter.

In that article I presented a number of suggestions contained in a report of mine to the National Advisory Committee for Aeronautics which I had submitted to that organization in 1919 while I was representing that Committee in Europe.

The suggestions contained in that report can be summarized as follows:—

The appointed task of the proposed Congress of representatives of aeronautical laboratories and other aeronautical technical and Scientific organizations should be:—

1st—To agree on a number of tests to be made in existing wind tunnels both in this country and in Europe on some standard model, or models, with a view of determining the influence of local conditions prevailing in each wind tunnel (method of attachment of the model to the forces measuring device, dimensions of model as compared to the dimensions of the wind channel, state of turbulence of the air flow, etc.) and the necessary corrections to introduce into the calculations of the results obtained in each wind tunnel on the same model in order to bring such results in line with those obtained in other wind tunnels.

At present such a divergency exists between experimental results obtained in various wind tunnels, when no such divergency should exist, that the confidence of aircraft manufacturers and designers in the usefulness of wind tunnel research work is badly shaken. Such a dangerous situation could be corrected with the organized cooperation of scientists and technical men engaged in research work in aeronautics who know better than anybody else where the trouble is to be found and who, furthermore, are eager to cooperate with each other, if the initiative is taken by some responsible party in calling a truly international congress of representatives of aeronautical Scientific organizations for the purpose of investigating the causes of the trouble and finding the remedy.

2nd—The proposed Congress of Aeronautical experts should make up the matter of definitions, symbols and graphical methods used in aeronautical reports, books and other publications which, at the present time, in the absence of any uniform standard accepted and adopted by leading scientists and aeronautical organizations, same as are adopted in statics, dynamics and in the art of applied engineering, (as for instance in the testing of materials) follow the line of thought of some particular group of technical men without any reference to the symbols, the terminology and the graphical methods of representation used by other groups of technical men in other countries. Here again we are confronted with the fact that Scientific and technical aeronautical reports and publications have no other excuse for being edited than their usefulness in facilitating the task of aircraft designers and manufacturers in designing and manufacturing better aircraft.

It is already bad enough that the people of the world do not talk the same language, if we add to this the self imposed handicap of a different scientific language spoken in each country in aeronautical publications, I do not see how we are going to be fully benefitted by the efforts made by scientists and technical men all over the world who are trying to perfect for us a new means of transportation which will have a tremendous influence in the progress of this civilization of ours.

We cannot too strongly insist on the fact that when in reading a report we are stopped either by the meaning of a symbol or by the value of a coefficient it is impossible to follow the sequence of ideas and the report is usually thrown aside.

The proposed Congress can remedy to such a state of things if the matter is approached in a true spirit of international cooperation in the scientific and technical progress of aeronautics, by adopting some fundamental standards which, without any doubt, would be accepted by technical writers all over the world.

How the Discussion on Standardization Started

The suggestion contained in my article of June 20th, 1919 in the AERIAL AGE, gave rise to a very interesting discussion in that review which was contributed by leading aeronautical authorities and, furthermore, it found an echo in the First International Congress of Aerial Navigation and in an in-

formal congress of leading Scientists and technical men which was recently held at Innsbruck (Tyrol).

Considering the great importance of the subject and the urgent need of arriving at a practical conclusion of the very regrettable state of affairs prevailing at present in the technical and Scientific field of aeronautical work, due to the delay in calling the proposed congress of representatives of leading aeronautical laboratories, scientists and technical men engaged in aeronautical research work in every country, a little history of the case and a resume of the opinions expressed by leading aeronautical authorities on this matter shall be probably helpful.

On May 1919 I was appointed Technical Assistant in Europe to the National Advisory Committee for Aeronautics for the purpose of establishing the promotion of a prompt and cordial exchange of scientific and technical data and information on research and experimental work in aeronautics and sciences thereto allied between the United States on the one hand and the Governments, private institutions and individuals in Europe on the other hand.

In October 1919, in a report to the National Advisory Committee for Aeronautics prepared by W. Margoulis, former director of the Eiffel Aeronautical Laboratory, and at that time my assistant in Paris and Aerodynamical expert of the Paris office of the Committee, the need for the inauguration of a cordial spirit of cooperation between the various leading scientists and organizations doing research work in aeronautics both in Europe and in the United States was pointed out, and the suggestion was made that the Committee should take the initiative in organizing a congress of representatives of aeronautical laboratories to be held in Paris for the purpose of arriving at a mutually satisfactory agreement on the means to be devised for obtaining:—

1st—More reliable results in wind tunnel experimental work, based on a better knowledge of existing conditions in each wind tunnel,

2nd—the adoption of uniform fundamental symbols and definitions in aeronautical reports and publications,

3rd—the adoption of standard graphical methods of representation of ordinary test results so as to facilitate the comparison of results obtained in various countries,

4th—the adoption of a standard method of classification and indexing of aeronautical publications so as to facilitate research work.

The National Advisory Committee for Aeronautics approved all of the above suggestions with the exception however that, considering the fact that the British Advisory Committee for Aeronautics had contributed during the war a good deal more than the corresponding American Committee to the advancement of aeronautics, it was deemed desirable that the initiative in originating a move such as I had suggested would be taken by the British rather than by ourselves.

Accordingly I took up the matter with the British Advisory Committee for Aeronautics and communicated to them the views of the N.A.C.A. on this matter.

In 1920 an invitation was issued by the British Advisory Committee for Aeronautics to our own Committee and to the leading aeronautical laboratories in France, Holland and Italy to conduct a number of comparative tests in their various wind tunnels on the same model—No invitation was issued to German and Austrian Laboratories to participate in these tests, and no provision was made for agreeing on the unification of symbols, definitions, graphical methods, etc.

In June 1921 I resigned my position as Technical Assistant in Europe to the National Advisory Committee for Aeronautics and I published in the AERIAL AGE under the title "Standardization and Aerodynamics" the suggestions contained in my earlier report to that committee regarding the organization of a Congress of representatives of aeronautical Laboratories both in Europe and in the United States. Since that time the following comments have been expressed in the technical press and elsewhere on this subject:—

German Comments

Prof. L. Prandtl, Director of the Aerodynamical Laboratory of the University of Göttingen, Germany and one of the foremost German scientists who has greatly contributed to the present stage of development of Aerodynamics, approves of the idea of calling the proposed congress, which however, he suggests, should be preceded by an exchange of views by correspondence between those participating to the Congress, so as to prepare the ground for a quick settlement of the various points involved. He offers a number of valuable suggestions as to the way comparative tests should be made in the various wind tunnels in order to bring about a better agreement between testing results obtained in various countries.

Dr. Ing. W. Hoff, Director of the Deutsche Versuchsanstalt für Luftfahrt at Adlershof, Germany, in a letter addressed to me endorsed Prof. Prandtl's comments and suggestions.

Prof. Von Karman, Director of the Aerodynamical laboratory of Aachen, Germany, points out the important need of reaching an agreement on the matter of standardization of symbols, coefficients and methods of measurement of air speed in wind tunnels. He points out the many objectionable features of the present state of things which is fraught with danger to the science of Aerodynamics—he thinks that an international aeronautical association organized along the same lines as the International Society for Testing Materials would provide a very good permanent medium of exchange of views between Scientists of all nations in the interest of Standardization—he approves of the idea of calling a congress of representatives of aeronautical laboratories which he suggests should be instrumental in laying the foundation of a permanent International Scientific Aeronautical Association. (Aerial Age, January 2, 1922)

Italian Comments

Col. Ing. G. Costanzi former Director of the Royal Aircraft Establishment in Rome, Italy, who during and after the war was the representative of the Italian Air Service to the Supreme War Council in Versailles, and the technical representative of Italy to the permanent Interallied Aeronautical Commission in Paris approves unreservedly the calling of the Congress and the suggested matter to lay before the Congress for discussion. He emphasizes the necessity of putting a stop to the prevailing lack of agreement between experimental results obtained in various laboratories. He also states that it would be unconceivable to reach any agreement in this matter without inviting the representatives of German Aeronautical Laboratories to the proposed Congress which, in his estimation, should be held in Germany, where aeronautical works of the highest order of both scientific and practical importance have been originated in the last few years. (Aerial Age, February 20, 1922)

Lieut. Col. Ing. R. Verduzio, Director of the Aeronautical Experimental Institute in Rome, Italy, considers the suggestion as a timely one, approves the program laid out for the Congress and states that Italian Aeronautical Services shall be very glad to cooperate to its realization. (Aerial Age, April 3, 1922)

Lieut. Col. A. Guidoni, Aeronautical Attache to the Italian Embassy in Washington and a well known authority in aeronautics, suggests in a letter to the writer that the matter of the adoption of the metric system in aeronautical measurements should be taken up by the Congress in connection with the matter of Standardization of Symbols. He points out that the Interallied Aeronautical Committee had already started a very important work of Standardization which could be taken as a basis for further expansion by the proposed Congress.

French Comments

W. Margoulis, former Director of Eiffel Laboratory, Paris, France discussing the tests suggested by the British Advisory Committee for Aeronautics, points out that comparative tests in wind tunnels, in order to serve the purpose for which he originally suggested them, must be both numerous and systematic in order that, as a whole, they may characterize the air-flow in each wind tunnel. The tests suggested by the British Advisory Committee for Aeronautics are to be made on a model of Streamline body supplied by the National Physical Laboratory and successively tested in the various laboratories in England, France, Holland, Italy, and the United States. Mr. Margoulis points out that in October 1920 in a paper read by him at one of the monthly meetings organized in Paris by himself and the writer for the discussion of Aeronautical problems (and which was published in the "Technical Review of Aeronautical Works" issued by the Paris office of the National Advisory Committee for Aeronautics) he suggested that comparative tests in wind tunnels, in order to be effective, must include tests on spheres, cylinders and streamline bodies of different dimensions and aspect ratio, tested at all available speeds in each wind tunnel and also in the open air on the aerodynamical truck of the St. Cyr Institute, so as to supply a much needed knowledge of free flight tests of models as compared to wind tunnel tests of the same models. (Aerial Age, March 6, 1922)

Austrian Comments

Dr. Ing. Richard Katzmayer, and Prof. Ing. Richard Knoller, of the Aerodynamical Laboratory of the Technischen Hochschule of Wien, Austria both agree on the urgent need of calling an International Congress of representatives of Aeronautical Laboratories and suggest preliminary comparative tests in wind tunnels of various countries on standard bodies such as Spheres, Streamline bodies and one or two airfoils, the same models to be successively tested in the various wind tunnels. These preliminary tests to be made for the purpose of determining what the writers call a "laboratory factor" or a con-

stant expressing of all those elements which are peculiar to each wind tunnel and which cannot be deduced mathematically, such as: turbulence of the air stream, ratio between dimensions of model and dimensions of working section of wind tunnel and, especially, the influence of the method of fastening the model to the balance.

Prof. Knoller and Dr. Katzmayer also state that one of the most important tasks of the proposed congress should be the standardization of symbols and definitions used in aerodynamics and make suggestions along this line. Prof. Knoller as early as the year 1914 suggested the adoption of absolute units, fundamental formulas used in aerodynamics—as to the unification of methods of graphical representation it is pointed out that both in Germany and Austria the same methods are used. (Aerial Age, May 8, 1922)

Dutch Comments

Dr. E. B. Wolff, Director, Dr. C. Koning and Dr. A. G. Baumbauer in charge of the aerodynamical tests at the Aerodynamical Institute of Amsterdam (Rijks-Studienst voor Luchtvaart), entirely agree on the necessity of calling the proposed congress and unreservedly approve of the suggested program of activities of such congress. On the matter of comparative wind tunnel tests, they agree on the preliminary limited program suggested by myself but they suggest an additional number of Systematic tests to be undertaken by only a few of the most up-to-date laboratories in order to separate the causes of errors in wind tunnel experimental work as due to: the method of measuring forces, the influence of the boundaries of the air stream and the nature of the air stream itself. This last cause of error, which includes: irregularities of the air velocity at different points of the cross section of the wind tunnel in regard to time, turbulence of every kind and variation of static pressure, however, should be investigated quite thoroughly in every wind tunnel. (Aerial Age, June 1922)

American Comments

Dr. A. F. Zahm of the Aerodynamical Laboratory, Bureau of Construction and Repair, U. S. Navy, believes that the inclusion of a very great number of laboratories in the comparative tests is not advisable at the beginning, but he is certainly in favor of making these tests in the most important aerodynamical laboratories and he points out that in order to bring about the desired results, the experimental program adopted should be at least as comprehensive as the one suggested by Dr. E. B. Wolff in the Aerial Age of June 19, 1922, and should be followed up in accordance with a common plan of attack and with a common formulated theory to furnish guidance and precaution. In two papers published by the National Advisory Committee for Aeronautics (Note No. 23 and Report No. 139) Dr. Zahm had emphasized this feature when the committee was working on its program of comparative wind tunnel tests which we will mention later on. He also believes that the most direct way to study accurately and convincingly the correction to be made for Reynolds numbers in applying model data to aircraft, would be to insert the full scale craft in a wind tunnel of suitable size and he suggests the building of a wind tunnel 10 meters diam. x 20 meters long at the throat providing a wind stream of 10 to 30 meters per second and requiring about 5000 horse-power. In his opinion, such a wind tunnel would be more useful to aeronautics than anything else at the present time. (Aerial Age, September 1922).

In connection with Dr. Zahm's remarks on the usefulness of a large wind tunnel allowing aerodynamical tests on full size aircraft I might mention here that a complete project of a wind tunnel of the same dimensions and requiring the same power as the one mentioned by Dr. Zahm was prepared by Mr. W. Margoulis for the Belgian Government and was transmitted by myself to the National Advisory Committee for Aeronautics in 1920, strongly recommending that it should be taken under consideration. Also, in 1920, a project of a compression wind tunnel (this project also by Mr. Margoulis) was submitted to the Committee by my office in Paris and eventually the tunnel has now been built at Langley Field and shall probably prove to be a very useful testing device, without however detracting any from the very practical (although rather costly) usefulness of a large wind tunnel allowing making tests on full scale aircraft. The National Advisory Committee for Aeronautics, replying to a letter of mine of last May requesting a statement of the present views of the Committee on the matter of the Congress of representatives of Aeronautical Laboratories which I suggested to them in 1919, makes the following statements:—

(1) "The standard tests mentioned by the British Aeronautical Research Committee are entirely separate from the tests that we have outlined for the wind tunnels of this country. There is however, a connection between the work of our Committee and the Canadian Air Board and it is contemplated that the models for test in wind tunnels prepared by the Aeronautical Research Committee will be forwarded to our committee

by the Canadian Air Board, after they have been tested in the wind tunnels in Canada. By the same arrangement we will forward the models prepared by this Committee to the Canadian Air Board, and it is contemplated that when the tests of models are made in all the wind tunnels in this country, the models will be sent to Europe after tests have been conducted in Canada.

(2) The aerodynamic Laboratories of Germany and Austria were not excluded from the general list where it is proposed to have the models tested outside of the United States.

(3) The Committee is very sympathetic in regard to reaching an understanding with all countries for the standardization of symbols and methods of graphical representation used in aerodynamics.

(4) The Committee is not willing to take the initiative in the forming of an International Congress for the Standardization of aerodynamics. *Such a congress must of necessity be international in scope and it would be impossible for the Committee to have an official representative there, as the United States Congress does not look with favor upon the United States being officially represented at any international conference.* We would, however have a representative present who will probably join in the discussion but would not have the official standing necessary to vote."

British Comments

The British Aeronautical Research Committee answering a letter of mine requesting a statement of their point of view in the matter of the proposed Congress writes to me:—

"Your letter of March 28th was brought to the attention of the Research Committee at their meeting of April 11th, 1922. They were interested to learn of the steps that had been taken to provide a preliminary exchange of views between a number of experts who had communicated articles in the "Aerial Age" but they do not consider that the time is yet come for the proposed congress of representatives of aeronautical research laboratories. Perhaps the best step that could be taken to co-ordinate the work of these different laboratories has already been projected, since the international trials on certain models have commenced and the models are en route to the various laboratories approached by the British Aeronautical Research Committee. It seems doubtful whether any additional advantage can be obtained in calling together, at a great expense, a congress of the proposed nature, since at present there is only a relatively small quantity of research work on aerodynamics being carried out throughout the world, and the best means of co-ordinating work already published arises with the collection of results of tests by the various laboratories on the same models and this is in hand.

We are not at present aware of what steps have been taken to co-ordinate the standardization of aeronautical terms and symbols. Some years ago, the Royal Aeronautical Society prepared a glossary of aeronautical terms, and later the American Authorities prepared a similar glossary. These agree in most respects. Since that date, the French Authorities have translated the English glossary and are, we understand, in touch with the British Engineering Standards Association with reference to the new revision of the old glossary, which is being prepared by this Association in co-operation with the Royal Aeronautical Society, the Air Ministry, The Aeronautical Research Committee and other technical aeronautical bodies in this country."

Comments Made at the First International Congress of Aerial Navigation

At the First International Congress of Aerial Navigation held in Paris in November 1921 the matter of international co-operation in systematizing wind tunnel work leading to the adoption of uniform fundamental symbols and definitions was the object of a lively discussion contributed by representatives of French, Italian, Dutch, Spanish and other European aeronautical laboratories. American and British laboratories were conspicuously absent at this First International Congress of Aerial Navigation and German Laboratories were not allowed to join.

Mr. Herrera, Director of the Aerodynamic Laboratory of Madrid, Spain, at one of the meetings of The Technical Committee of the First International Congress of Aerial Navigation suggested the organization of an "International Union of Aerodynamic Laboratories" headed by one laboratory (he suggested the Eiffel Laboratory) which should formulate a program of comparative tests on a number of models. According to Mr. Herrera, the same set of models should be successively tested in the various laboratories, following the particular method of experimentation of the laboratory making the tests. After the tests have been completed in all laboratories, the results should be compared and, from the results of such a comparison, enough data should be available as to allow of the adoption of uniform coefficient and the standardization of methods of future experimental work in wind tunnels. (Frankly we fail to see that the

matter is so simple as Mr. Herrera seems to think). Mr. Herrera also suggested that this work should be planned for by the one laboratory representing the proposed International Union of Aerodynamic Laboratories and be carried through by the various Laboratories under the supervision of this super-directing laboratory (the Eiffel Laboratory).

Prof. Soreau, Vice President of the Aero Club of France and Chairman of the Technical Committee of the First International Congress of Aerial Navigation, objects to Mr. Herrera's suggestions for two reasons: 1st—because he does not see that it is possible to establish a supergovernment of aerodynamical laboratories as suggested by Mr. Herrera and, 2nd—because in order to compare the results obtained in two laboratories it is essential that the conditions under which experiments are made be the same, therefore, it seemed to him that the proper thing to do would be to adopt first uniform methods of experimentation (as for instance the same method of attaching the model to the balance) and then make the tests, rather than doing the reverse as Mr. Herrera suggested.

Dr. E. B. Wolff, Director of the Aerodynamical Laboratory of Amsterdam, Holland, referring to his correspondence with the National Advisory Committee for Aeronautics and the British Aeronautical Research Committee regarding the proposed comparative wind tunnel tests, states that after receiving the invitation to participate in the tests suggested by the British Aeronautical Research Committee he has not heard any more about this matter. He suggests that something should be done, without any further delay in order to start the proposed comparative tests on the same models in the various tunnels.

Mr. Louis Breguet, French Aircraft Designer and Manufacturer, endorses the suggestion made by Mr. Herrera and by Dr. Wolff and suggests the appointment of a committee charged to make definite suggestions leading to the standardization of methods of experimentation in wind tunnels and to the standardization symbols used in aeronautical works.

Mr. W. Margoulis, reports to the Congress the initiative taken by himself and by myself in 1919 in order to bring about the proposed comparative tests. He deplores that the British Aeronautical Research Committee has not gone any further in the realization of its test program than issuing an invitation to participate in some comparative tests on a model prepared by that committee, which, however, has never been sent to the various laboratories to which the invitation was issued.

Prof. Soreau, chairman, answering Mr. Margoulis's remarks regarding our unsuccessful efforts in 1919 to try to induce the National Advisory Committee for Aeronautics to take the initiative in bringing about a much desirable co-operation between aerodynamical Laboratories, states that he knows the reasons why both Mr. Margoulis and myself failed three years ago. He could not reveal what the reasons were but he could state nevertheless that the stumbling block was represented by some governments (meaning the United States, quite evidently) who are not inclined to take part in international conferences. Such being the case, he said, it would seem that the appointment by the First International Congress of Aerial Navigation of a committee such as it had been suggested by Mr. Breguet would not constitute the most advisable step to take at the present time, especially considering the fact that most of the aerodynamic laboratories in every country are under government control. In his opinion, the best thing to do would be to adopt a number of resolutions and submit them to the French Under-Secretary of State for Aeronautics which would take up the matter of Standardization of Symbols notations and methods of experimentation with foreign governments.

Mr. Breguet and Mr. Prix of the St. Cyr Aerodynamic Institute insist on the appointment of a committee.

Col. Verduzzio, Director of the Aerodynamical Laboratory of Rome, Italy, points out the great disadvantage under which the work in aerodynamics is proceeding at present in the absence of an understanding between aerodynamic laboratories on the matter of experimental methods adopted and in the absence of uniform symbols and notations having the same meaning in every country. The latter, according to Col. Verduzzio is of the greatest importance and he submits to the Congress a list of symbols and notations prepared by the Italian Aeronautical Technical Services which, he suggests, could be taken as a basis in the discussion for the adoption of international standards. Col. Verduzzio refers to the failure of the British Aeronautical Research Committee to carry through the proposed program of international wind tunnel tests on a model supplied by them and, in order to get started, he suggests that each Laboratory should make its own model from the same drawing and start the tests.

Col. Fortant, Director of the French Technical Section of Aviation, suggests that, independently of any governmental action by the Under-Secretary of State for Aeronautics in

dealings with foreign governments in the matter under discussion, as suggested by Prof. Soreau, the suggestion made by Mr. Breguet and others regarding the appointment of a committee be at least unofficially adopted and that the representative of aerodynamic laboratories attending the Congress meet together and exchange their views on the matter of symbols and comparative tests which, in their opinion, should be the object of an international agreement.

Resolutions Adopted by the International Congress of Aerial Navigation

At the close of the First International Congress of Aerial Navigation the following resolutions were adopted expressing the views of the Technical Committee which were offered by the Congress with the suggestion that they should be adopted by Governmental and civilian aeronautical organizations:

"Resolution No. 3—To make a study of the measures which may be immediately adopted in the test methods of aerodynamic laboratories in order to make it possible to compare results; in particular to define the geometrical forms and the material realization of a large number of typical models, which tested systematically in well defined conditions, would serve, in some sort, as a characterization of a wind tunnel; also to bring about an agreement that the same collection of such models be tested successively in the various laboratories.

"Resolution No. 4—Unification of terms and notations employed in the aeronautical publications of the different countries."

The appointment of a committee charged with the actual carrying through of the work outlined in resolutions No. 3 and 4 which had been advocated by Mr. Breguet and others did not take place and, besides expressing a more or less sentimental wish that somebody, somewhere, would do something in the direction pointed out in the two resolutions quoted above, the First International Congress of Aerial Navigation did not do a thing for bringing about the much desired international wind tunnel tests and the standardization of symbols, terms and graphical methods employed in aeronautical publications of the different countries represented at the Congress, in spite of the fact that urgency of such a measure had been pleaded for by the representative of every aeronautical laboratory attending the congress.

It is no wonder, however, that the first International Congress of Aerial Navigation could not accomplish anything in a matter such as this which required the cordial co-operation of scientists of every nation, when we stop to consider that American and British scientists were conspicuously absent and German, Austrian and other scientists of former enemy nations were not allowed to join this congress which was held under the auspices of the French Government.

The Moral of a Sad Story

From the above history of the fruitless efforts which have been made during the last three years by scientists and technical men of all countries interested in aeronautics in order to bring about a much needed international co-operation in aeronautical research work in the interest of aeronautics as a science and as a new and tremendously important branch of engineering, we can draw the following conclusions:

(1st) It is well recognized by all leading authorities in aeronautical research work that the lack of co-operation between the various aerodynamic laboratories in adopting a common standard whereby the results of wind tunnel tests can be intelligently interpreted and compared to each other (wherever it stands to reason that such a comparison should be possible) is fraught with danger and tends to destroy the confidence of aircraft designers and manufacturers in wind tunnel tests which are now the only scientific guidance that aerodynamics can give to the aircraft designing engineer in order to allow better and safer design of aircraft.

(2nd) The present chaotic condition existing in the matter of symbols, definitions and methods of graphical representations used in aeronautical technical reports and publications edited in various countries, makes it almost impossible for anybody who is not familiar with the technical aeronautical terminology adopted by each country to derive any benefit from publications and reports edited in any other country than his own.

(3rd) The present lack of co-operation between aerodynamic laboratories and the handicap brought about by the absence of a uniform scientific aeronautical language having the same meaning in every country, is not due to a lack of appreciation by scientists and technical men engaged in aeronautical research work of the very undesirability of the prevailing situation. On the contrary, almost all of them are ready to enter into and to abide by any sort of international agreement which will correct the present state of affairs.

(4th) Due to the fact that all leading aeronautical laboratories and other aeronautical scientific organizations in the world are under government control, any initiative in the

desired direction can only be taken at the present time by one or more, governmental aeronautical institutions with the approval and the active support of the government machinery back of it.

(5th) Any move of this sort originated by the aeronautical services of any of the big nations in Europe is bound to be influenced by political considerations, by limitations imposed by the treaty of Versailles, and by resolutions officially adopted during the war at interallied meetings of prominent scientists and representatives of academic bodies on the matter of post-war co-operation with scientists of, at that time, enemy countries.

(6th) Quite evidently under these conditions it is impossible to reach a truly international agreement, such as it is desired, as long as German aeronautical progress and German scientists are either ignored or snubbed.

The failure of the First International Congress of Aerial Navigation to work out any plan for meeting the situation, which had been brought to their attention by those most interested in and most concerned with the desirability of reaching an agreement on the matter of international co-operation in aeronautical research work and on the matter of standardization of aeronautical technical terminology, provides the best illustration of the futility of placing any hopes in the outcome of the vague recommendations presented by its technical committee to the French Under-Secretary of State for Aeronautics.

(7th) The program of wind tunnel tests on a single model successively tested in various wind tunnels in Europe and in America which was outlined by the British Aeronautical Research Council almost three years ago (and which, as far as I know, has not materialized as yet) did not include and does not include at the present time, for all I know of, the co-operation of German Aeronautical laboratories. Furthermore that program was not prepared with the collaboration of any of the laboratories invited to join in the proposed tests; it was simply a British ready-made program of wind tunnel investigation work which discussion in the Aerial Age of this subject has failed to prove that it was the most acceptable one to all concerned. On the contrary that discussion has led to the contribution of a good many suggestions by prominent aeronautical authorities which most certainly should be taken into consideration before formulating a program of international co-operation in a work which is to be purposely undertaken in the interest of the scientific and technical progress of aeronautics in all countries.

Our National Advisory Committee for Aeronautics an Important Factor in International Aeronautics

When three years ago I suggested to and strongly urged upon our National Advisory Committee for Aeronautics to take the initiative in calling a meeting in Paris of the representatives of leading aeronautical laboratories in the United States and in Europe for the purpose of outlining a program of international wind tunnel tests which would have eliminated the present objections to wind tunnel experimental work, and which would have laid out the basis for the adoption of a much needed consistent uniformity in aeronautical technical terminology, I was prompted by the fact that I knew that our National Advisory Committee for Aeronautics was the only aeronautic scientific organization in the world which could have undertaken this task and carried it through to a successful conclusion.

In fact, this Committee had the assurance of the most effective co-operation of scientists of all nations (former allied and former enemy nations) who, in spite of the official taboo which separated and still separates in most European countries scientists in two groups: *friendly* and *enemy*, would have welcomed any attempt on our part to bridge the gap, insofar at least as aeronautics are concerned.

Furthermore, our National Advisory Committee for Aeronautics being as it is directly responsible to the President of the United States and to Congress only, is the only aeronautical scientific organization in the world under Government control which is independent of all governmental departments, while at the same time it co-operates with all of them as well as with our national aircraft manufacturing industry, with engineering societies, universities and other educational and academic bodies engaged in aeronautical research work in this country.

The contribution made by this Committee to the advance of research work in aeronautics during the last five years, with the insufficient funds placed at its disposal by Congress, places our National Advisory Committee for Aeronautics in a position of natural leadership in the scientific field of aeronautics, and furthermore, the disinclination on the part of the American people to discriminate between scientists of former enemy and former friendly and neutral nations would have created an atmosphere of confidence and a spirit of

effective co-operation in a meeting of representatives of aeronautical research laboratories organized by this Committee. This, however, could not be accomplished due to the fact that the National Advisory Committee for Aeronautics must look upon Congress for guidance on all matter more or less directly related to our dealings with foreign nations. As it is stated before, the Committee (1) is very sympathetic in regard to reaching an understanding with all countries for the Standardization of symbols and methods of graphical representation used in aerodynamics (2) it is more than sympathetic in regard to wind tunnel tests leading to a definite and practical utilization in the future of wind tunnel work and (3) it is not disposed to ignore the existence of German and Austrian Aeronautic laboratories and scientists. On the contrary this Committee has been the first one which has adopted for wings the same co-efficients used by the Göttingen Laboratory simply because they were the most logical coefficients to adopt. (This example, I understand, is going to be followed by French laboratories. As far as British laboratories are concerned, it is very doubtful indeed if they will ever adopt symbols coefficients and graphical methods of representation others than their own).

The Views of Congress on International Coöperation

The stumbling block on the road of progress and international coöperation at least in the scientific field of aeronautics) which could have been brought about by the only governmental aeronautical research organization in the world capable of obtaining the desired results, is represented by the unfavorable standpoint from which our present Congress is inclined to look upon any international conferences between ourselves and European powers. Under the circumstances, it is quite natural that the National Advisory Committee for Aeronautics should not be willing to take the initiative in the organization of an International Congress for the Standardization of Aerodynamics. As a matter of fact, should such a congress be organized by another nation, our National Advisory Committee for Aeronautics could not even be officially represented there, same as it has not been represented at the First International Congress of Aerial Navigation or at any other of the international aeronautical conventions which have taken place in Europe during the last three years, where most important decisions affecting international aerial navigation have been taken in our absence, without any reference whatsoever to our present or future interests in that direction.

It is not this the proper place for discussing either the wisdom of the narrow mindedness of our policy of isolation (neither splendid nor always consistent with our national interests) which we are pursuing under the present Congress in every event taking place, sometimes three and sometimes twelve miles off our shores, but this is certainly the place where we can say that the unwillingness of Congress either expressed to, or assumed by, the National Advisory Committee for Aeronautics, to allow that body, who has done and is doing some splendid work, to establish closer ties between American and European aeronautical scientific research institutions, is neither consistent with the progress of aeronautics nor with dignity of an organization which should be left free to work in the interest of science unhampered by political considerations.

When three and a half years ago I suggested the establishment of an office in Europe of the National Advisory Committee for Aeronautics for the purpose of establishing and maintaining a cordial exchange of thoughts between American and European Scientists working on Aeronautics and Sciences thereto allied, and when my suggestions were approved by that Committee and I was appointed its representative in Europe for the purpose of carrying through that program, the keynote of our National policy was: co-operation with Europe. We went too far, however, or probably our motives and our lofty ideals which prompted our desire to co-operate with Europe in the re-establishment of order and peace in the world were not met with in the same spirit such as we were actuated by. At any rate, with the advent of the new administration, a complete reversal of our foreign policy took place and, *he las*, I soon discovered that the fine spirit of international scientific co-operation in Aeronautics, which had provided the only reason for establishing a foreign office in Europe of the National Advisory Committee for Aeronautics, had been damped to such an extent that my activities in promoting co-operation were actually embarrassing the Committee. After two years of persistent efforts I had to withdraw from a work which, however, I feel has sown good seed which shall bear fruits later on when it will be more fully realized, both in this country and in Europe, that the root of all our evils in the difficult period of evolution of the human race that we are going through is the lack of co-operation between the intellectuals of all nations.

The Discussion Has Served its Purpose

The efforts made by Mr. Margoulis and myself during the last three years for promoting a congress of representatives of aeronautical research laboratories and other scientists working in aeronautics in the interest of the scientific progress of Aeronautics have not been lost, and the discussion in the Aerial Age of the subject "Standardization and Aerodynamics," I feel, has served its purpose which was to show that intellectual co-operation in aeronautics can be achieved and must be achieved by taking into consideration the views of all before trying to place our own interpretation on what should be done in the pursuance of a plan calling for the co-operation of others.

The suggestions that we made three years ago on the subject of wind tunnel tests have been adopted in principle by all aerodynamic laboratories, however, both the British Aeronautical Research Council and our National Advisory Committee for Aeronautics have each formulated a test program of their own without taking under consideration the views of other laboratories and each proposes to go ahead with its own program and make its own models, test them according to its own ideas and then ask other laboratories to duplicate the same tests on the same models.

Other laboratories, I understand, are planning to do the same thing and the consequence of this lack of co-operation between the various laboratories in formulating a unique program of experimentation agreeable to all shall bring about a useless loss of time and energies. Since the necessity of making these comparative tests has been recognized by all concerned why not try to make them as complete as possible in a true spirit of international scientific co-operation?

The discussion of this subject, both in the Aerial Age and at the First International Congress of Aerial Navigation, has supplied enough elements to approach the problem of Standardization and Aerodynamics on some sort of well defined basis. It should not be difficult to co-ordinate the various suggestions made by the directors of the various laboratories and to find a common ground on which an agreement might be reached. This can be accomplished mostly by correspondence. After an agreement has thus been reached on general lines, a meeting of American and European representatives of aerodynamic laboratories and leading scientists engaged in Aeronautical research work could be easily arranged for. A meeting of this sort bringing together scientists of all nations, which on account of the war find themselves separated by nationalistic barriers, would make it possible to work out the details for carrying through a program of immediate and future actions and, furthermore, would supply the human factor as represented by the personal contact of men having the same object in mind: the progress of science.

Let Us Have Peace

In spite of the war, in spite of the tremendous turmoil of hate, lust and avarice, in spite of the re-awakening of all the baser instincts of the human race which the war has unchained, we can see the signs of a new era dawning upon us. Social reforms based on the old standards of personal and nationalistic advantages shall never restore peace and order, unless we realize first the true meaning of the law of brotherhood and stand ready to compromise on the matter of personal rights, privileges and advantages in the interest of all.

The intellectuals of the world, scientists and technical men engaged in the work of developing and perfecting new inventions are the pioneers of this new era. It is up to them to realize the meaning of the divine love, of which science is the noblest expression, and it is up to them to give the example and to teach the objective lesson that the world needs: The unselfish co-operation of all in the realization of a common good.

Aeronautics and the enormous possibilities offered by aeronautics, which represent the outstanding engineering progress born out of the war, points out the way to us where international co-operation of scientists and technical men starts.

We have in aeronautics a new science, a new branch of engineering, a new and fundamentally international means of communication. The men who are working in aeronautics are new men, they understand the need of co-operation, they are ready to co-operate with each other, they invite the leadership of a group of progressive scientists of a progressive nation to bring about the formation of a nucleus of the great brotherhood of the intellectuals of the world.

Can I be blamed for continuing, after three years of efforts (not fruitless by any means) to look upon our National Advisory Committee for Aeronautics as the best adapted Aeronautical organization in the world for bringing about the desired results? Especially so when we consider that the Committee is in sympathy with the idea of an international congress of scientists working in aeronautics and would be ready to join in a discussion leading to a better understanding

of wind tunnel work and to the Standardization of Symbols, notations and methods of graphical representation used in technical aeronautical works, if it was not prevented from doing so by the stand taken by Congress on the matter of American participation to International conferences.

Only last September a pathetic appeal was sent by German and Italian Scientists working in aeronautics to scientists of other nations to take part in a meeting held at Innsbruck (Tyrol)—The invitation read: "The research work of the last years has brought about in all countries considerable progress in the development of the classical theories as well as of the fundamental problems of practical hydraulics and aerodynamics. On account of political events the interchange of ideas and personal intercourse among Scientists have been impaired. By the said meeting we intend to avoid whatever hinders at the present time the success of official international Congresses. We simply want to rally without any formalities the scientists interested in these special problems."

American, British and French Scientists did not answer the call of their German and Italian brethren, not because they did not want to, but because they could not on account of the unfortunate preponderance of political consideration over other considerations of higher nature. This seems to be the price that scientific research work in aeronautics must pay nowadays in order to obtain the scanty credits granted by the various governments for that purpose.

It is rather amusing to see that, of all governments subsidizing scientific research work in aeronautics, the German government should be the first one who has not opposed its veto to the action taken by Prof. Prandtl and by Prof. Karman in calling this first international congress of scientists working in aeronautics.

An Appeal to the National Advisory Committee
for Aeronautics

I wish to close the present discussion of the subject "Standardization and Aerodynamics" by appealing once more to the members of our National Advisory Committee for Aeronautics urging them to use their personal influence and the enormous prestige of the finest aeronautical Scientific organization in the world, for obtaining from Congress the recognition of the fact that a wider range of independence from political considerations by that Committee in the field of international co-operation in the interest of the scientific progress of aeronautics is worthy of the high standards of that institution and is consistent with our national interests.

The first step along the road of collaboration with Europe in the work of reconstruction (which, no matter if we like it or not, we shall have to travel sooner or later) it is just and

right that it should be made by American Scientists. Such a step would be entirely consistent with the desire repeatedly expressed by the nation, the President and by members of its Cabinet, to co-operate with European Nations in any constructive plan leading to the re-establishment of peace in the world.

Who can suggest of any better plan leading to the re-establishment of peace in the world than the one brought about by promoting an increased collaboration between Scientists and technical men all over the world? And if the initial move in that direction can be made by promoting peace and collaboration between scientists working in aeronautics who are ready and eager to fulfill the law of international brotherhood, why not let aeronautics lead the world along the path of intellectual evolution on which, in spite of all adverse forces we are steadily progressing?

Why short sighted and short lived political considerations should deprive this nation and our National Advisory Committee for Aeronautics of the great privilege of being able to make the first move?

Quoting President Harding's Words

The words spoken by the President at the Commemoration of the fourth anniversary of the Armistice truly represent the sentiment of the great majority of the American people on the matter of co-operation with Europe:—

"I think we have come to realize, as a nation, that we cannot hope to avoid obligations and responsibilities, often arduous and burdensome, as part of the price we must pay for our fortunate relationship to the confraternity of the nations. It will be greatly to the national benefit, I am sure, if those who most intimately participated in the events of the great world, and among them I, of course, include particularly the men of the overseas forces, shall always keep in mind the fact that their noble service to their country and civilization has imposed upon us a duty to recognize that henceforward we must maintain a helpful and sustaining attitude in all the broader relationships that involve the nations. Our first duty will, indeed, be to our own, but that duty cannot be adequately discharged in narrowness and selfishness.

"That we may be guided to a just judgment of the time and occasion for further proof of our interest in the common cause of humanity, and in choosing the methods whereby to discharge the obligation thus created, will be, I am sure, a fitting prayer for this armistice anniversary."

Let us keep in mind that we can help making this world safe for democracy in one way only: by taking our share of obligations and responsibilities in building up a new International: THE INTERNATIONAL OF BRAINS AND HEARTS.

TABLE IV
Evaluation of Thrust and Torque for Secondary Conditions :

Station	2	3	4	5	6
Radius.....	2.00	2.67	3.33	4.00	4.67
2 — r n.....	314	420	523	628	735
tan ϕ.....	.3180	.2383	.1910	.1590	.1362
c,os ϕ.....	.9530	.9727	.9822	.9876	.9909
ϕ	17° 38'	13° 25'	10° 49'	9° 2'	7° 45'
k.....	.0366	.0366	.0366	.0366	.0366
x°	—72.°	—8.2°	—6.2°	—5.2°	—4.2°
D ϕ — ϕ	19.5°	18.4°	14.8°	12.3°	10.3°
O.....	5.6°	4.6°	3.6°	2.6°	1.6° (approx.)
x	6.7°	5.6°	5.0°	4.5°	4.5°
CL.....	.495	.500	.420	.360	.330
L/D.....	12.65	13.65	14.50	16.50	17.00
J.....	4° 31'	4° 11'	3° 57'	3° 28'	3° 22'
ϕ'	23° 14'	18° 00'	14° 25'	11° 38'	9° 21'
tan ϕ'.....	.4293	.3249	.2571	.2059	.1647
sin ϕ'.....	.3945	.3090	.2490	.2016	.1625
$\phi' + J$	27° 45'	22° 11'	18° 22'	15° 6'	12° 43'
tan ($\phi' + J$).....	.5261	.4078	.3320	.2698	.2257
cos ($\phi' + J$).....	.8850	.9260	.9491	.9655	.9755
V (1 + $\frac{1}{2}a$).....	126.5	132.0	132.0	128.0	120.0
aV.....	53.0	64.0	64.0	56.0	40.0
2 — rn b.....	27.8	26.1	21.2	15.1	9.0
dT/dr.....	84.5	167	205	210	181
dQ/dr.....	89	182	227	226	191

TABLE V
Determination of Propeller Characteristics and Evaluation of Useful Power

J	Tc	Qc	K (M)	n	V	Pm	Pu
.30	.0827	.00965	45.0	1480	50.5	347	160
.40	.0750	.00827	58.0	1510	68.5	350	202
.50	.0645	.00765	67.0	1570	89.9	371	248
.60	.0517	.00673	74.7	1670	114.0	389	291
.65	.0445	.00613	75.2	1755	129.8	418	314
.70	.0367	.00545	75.1	....	....	....	....
.80	.0193	.00370	66.5	....	....	....	....

General Rules For Air Combat

A Post-war Paper on Pursuit Aviation by an Expert German Pilot—It Visualizes to the Lay Reader What Pursuit Aviation Means to the Sohrabs and Rustums of the Air

Surprise and Attack Regardless of Consequences:

The combating power of the one-seater lies in the attack. In an attack, the surprise and a fearless closing with the opponent as near as possible (less than 100 meters) before the opening of fire, play the chief part. The one-seater makes his surprise attacks, flying out of the sun, toward the enemy, or in the steepest dives.

Proper Shooting Distance

The one-seater is only at the proper shooting distance when he flies into the enemy's propeller whirlwind and constantly has the feeling that he will ram the opponent at once. At such distances the large and close target must be hit by using the gauger and sights even with aiming errors; with the employment of light tracer ammunition the position of the stream of bullets can be frequently improved. The use of the aiming telescope at such short distances is not advisable. Firing at longer distances with the aiming telescope is solely to be used to shoot at a fleeing opponent—to force him, through short bursts at greater distances, to circle and to then cut him off while circling—or to help in time a far-away harassed comrade.

Attacking Direction.

The most effective attacking direction against one-seaters is the one from above to the rear, to the rear and from the rear below. Shooting the opponent from the front is in most cases not possible with the short shot possibility due to the speed of the aeroplanes and the blanketing of the pilot by the engine. An opponent, who shoots while swooping down from a great distance, betrays the beginner or shows shyness to engage in the curve combat at a close distance. Even accidental shots are rare with rare.

Working Together.

Fundamentally two one-seaters should always co-operate even in squadron formation. If one of the two attacks a hostile one-seater, his comrade does not take part in the air combat, but remains in readiness for immediate action and covers the rear back of the comrade against a surprise attack by other hostile aeroplanes. Only then is participation in the combat proper, if the opponent threatens to win the upperhand. The attacked aeroplane is, if it does not burn or break up, always closely pursued till its impact or landing. Turning away from an opponent on account of inexperience or a consequence of hostile action, even if only for seconds, means for the comrade in the vicinity not only the right, but also the duty to take part at once. Herewith

the fundamental rule remains, never to impede the curve combat of a comrade by a desire to open fire.

The Opening of the Combat.

With a prompt recognition of the hostile aeroplane turn at once against it, shoot and then try in curve combat to get in the rear or underneath him (if opponent has a rotating motor turn to the right if possible.)

When in doubt as to whether it is a hostile or friendly aeroplane, turn against it at once, push underneath the suspicious machine at full speed and only, if the comrade is recognized or opponent shoots, to pull high and return the fire. With a surprise attack from the rear, if there is no time to turn around, tip up steeply at once with full gas, once again pull up high and go into the curve or immediately with the most powerful rudderpush take the steepest curve.

Curve Combat.

In curve combat the curve must not be changed or downward steering be given, if the opponent ascends above. Herewith there is still the possibility of shooting the opponent from below, as it is not at all advisable, to go above an aeroplane, which can shoot upwards. The curve combat itself is always led with full gas. If the one-seater perceives, that in spite of his efforts the enemy will come behind him because of greater turning ability of his aeroplane or flying superiority, then quickly overdraw the machine in the curve, whereupon it stands at once on its head, turns 3 to 4 times quick as lightning round its own axis, and catches itself again on its own accord after a sudden fall of 100 meters at the most. The pursuer is in this way always shaken off for some time.

Rear Cover.

The one-seater operating alone over hostile territory is easy to combat, when fearlessly attacked, as he lacks the rear cover on the one hand, and on the other hand must strive again to reach his lines. Therefore, with attacks on captive balloons and in squadron combats beyond the front, constant team work is absolutely necessary. This supplies the necessary defense for the rear attack. Frequent practice is, however, necessary.

Combat of the One-Seater against Hostile Double-Seaters.

Herewith too, the surprise plays the chief part on our side and on the other side of the lines, besides making possible a quick rush across the danger zone of the enemy's movable machine gun. Suddenly push down in the steepest drop without shooting, place oneself at once behind or underneath the enemy and only at the last moment operate both rigid machine guns.

A flat straight-ahead flight with an attack on the body of the double-seater is absolutely to be avoided. It is wrong to shoot in an attack at distances of over 100 meters and if the opponent answers the fire, to turn. In this moment the enemy is offered a target which is easily hit and without danger to him.

Combat of the Double-Seater against Hostile One-Seaters.

With early recognition of the opponent give the observer notice, while still at a long distance, by short fire bursts, so that he will not be surprised (thus saving ammunition). If the hostile one-seater attacks, then curve with full gas and bring observer into position to shoot.

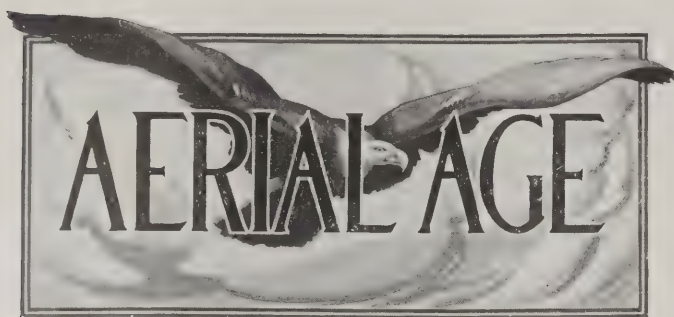
In case of doubt, whether it is a hostile or our own aeroplane, curve towards it, press underneath it with full gas and, if the enemy is recognized, bring observer into position to shoot from beneath to above.

With a surprise hostile attack at once curve steeply with most powerful rudder stroke, bring the observer into position to shoot. It is fundamentally wrong, to fly straight ahead or—when with shut off gas—to go straight ahead downwards.

The German reconnoitering aeroplane attacked by hostile one-seaters far beyond the line rids himself best of his bothersome opponents, by flying constantly zig-zag, as long as the enemy attacks, thus bringing the observer into position to shoot. If the pursuer is lost out of the line of sight for a moment the German double-seater then at once pushes away under full gas and takes advantage of the high speed of the heavy aeroplane. Generally the pursuer does not succeed in overtaking a second time and approaching in an effective distance (50 to 100 m.). Should the one-seater still follow, shooting at 4 to 500 meters, then do not curve nor return fire, but first, quickly put in new drums, turn, push beneath the pursuer and to bring observer in closest distance to shoot upwards. Fundamentally the most dangerous one-seater is the one which tries to get underneath the tail of the double-seater.

Combat of the Double-Seater against Hostile Double-Seaters.

Here the movable machine gun of the observer brings the decision. The task of the pilot herewith is, to bring his observer as often as possible into position to shoot and to curve in such a way that the opponent is offered no aim. An attack of the double-seater with the rigid machine gun will often stupefy the opponent. On our side of the lines the double-seater has also the duty to attack as well as to take part in the air battle of German one-seaters in the vicinity.



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Night Flying for the Air Mail

DURING the next few weeks the Air Mail will try out aerodrome lighting equipment from various manufacturers at fields every 25 miles along the course from Chicago to Cheyenne. This, in order to determine the best system for the purpose.

Each field will be equipped with a beacon which will have a visibility of approximately 35 miles. The fields themselves will be lighted by means of floodlights to illuminate the landing Ts and by boundary lights to determine the field limits. All buildings will be floodlighted to give, as near as possible, a day-time perspective and in every instance the lighting arrangement will be such that the lights will not shine in the pilot's eyes.

The Post Office believes that the lighting of the 'plane itself is by far the more important item. One of the Post Office 'planes is being fitted with electric landing lights by the Army Air Service at McCook Field.

Transcontinental Flying

THE army aviators who drove a monoplane from California to Indiana before they were compelled to alight missed their goal of a non-stop flight from ocean to ocean. But in flying two-thirds of the desired distance and the more difficult country without a descent in twenty-eight hours they proved the entire feasibility of the project. The hardy flyers who make the next attempt may reasonably expect to find it free from the handicap of a leaky radiator and burned-out engine.

At least there are the best of assurances that the feat will be accomplished in time and probably in the near future. A generation to whose fathers the pony express and the first locomotive across the plains were marvels of fast transportation can hardly be so surfeited with the exploits of aviation as not to feel a new thrill at the near prospect of flying across the continent in a continuous trip. As it is, the performance of Lieuts. Macready and Kelly is both a record-breaking achievement as a sustained flight for 2,060 miles and a notable example of resourcefulness in overcoming the obstacles of violent storms, mountain crosswinds and mechanical hazards. It is one of the great feats of aviation and comparable as a contribution to the development of long-distance flying with the high-speed records for short distances made at the recent Detroit contests. How far away is the Coast-to-Coast Air Limited, to cover the route, on the basis of the Pulitzer Trophy speed records, in from twelve to forty-eight hours? (Editorial in N. Y. World.)

Oxygen and Commercial Flying at High Altitudes

THE question of commercial flying under federal regulations, as proposed in a bill now before Congress for the creation of a Government "Bureau of Civil Aeronautics" is becoming of more immediate and definite interest to promoters of transportation lines, to engineers, insurance companies, pilots, business houses and to the traveling public on whose patronage success depends.

Economy is, perhaps, the first consideration. This means flight at high altitudes, probably at twenty-five thousand or more feet. How, then, are we to breathe comfortably and can we be kept warm? The attainment of high altitudes and the use of the heat available is now the solved problem of the supercharged engine.

However, some light on the medical aspect of high flying is shed by the research work for the National Advisory Committee for Aeronautics by Franklin L. Hunt on the subject of oxygen instruments, which have been employed thus far in the flying at great altitudes.

It has been shown that at altitudes above 15,000 feet the physical condition of aviators—and of the traveling public—is affected by lack of oxygen, unless artificial means is provided to supply the deficiency.

The physiological symptoms are: headache, which is usually the first noted; palpitation, fatigue, numbness of the limbs, pains in one or both ears, weakening of the attention, diminished sense of stability, which means much to the pilot; vertigo, faintness, and finally, loss of consciousness. It is obvious that the existing altitude records have been made with the assistance of someone or another oxygen apparatus.

It has been definitely determined that flying at altitudes of 20,000 feet or more for extended periods can not be undertaken without serious injury to the central nervous system of the aviator.

These physiological symptoms can be almost entirely avoided by supplying artificial oxygen during flight.

The normal man at full atmospheric pressure breathes approximately 16 times a minute. The volume of each inspiration is about one-half liter, so that 8 liters of air is breathed per minute, of which 1.6 liters is oxygen. This, however, is the minimum required. In the case of the pilot of an aircraft, the aviator is continually in a state of physical activity and, therefore, needs more oxygen. It has been found that 4 liters of oxygen per minute is not an excessive amount to supply, allowing for inevitable losses.

The pressure of the air at sea level is approximately 14.7 pounds per square inch. It decreases at the rate of approximately one-half pound per square inch for every 1000 feet of altitude for the first 10,000 feet and more rapidly thereafter. At 20,000 feet the pressure, and consequently the density, is only one-half that at the surface of the earth. Consequently, the traveler would obtain but one-half the normal supply of oxygen at each inhalation.

For high altitude flights it appears that approximately 150 liters of artificial oxygen must be supplied per person per hour, and under average present conditions a supply for a 2½-hour flight is carried. This oxygen is stored either in bags in the fuselage of the machine compressed in steel cylinders or liquefied. From the containers the oxygen is supplied to the pilot through reducing and regulating valves, a flow indicator and tubing to a mask worn over the face.

With the inauguration of high-altitude, high-speed long-distance airplane lines, one may expect air tight

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THE NEWS of THE MONTH

Aerial Photography and the Oil Fields

The airplane has been put to one of its most novel uses in the taking of pictures for a mosaic of the Salt Creek and Teapot oil fields in Wyoming. This unusual photographic feat was performed for the Bureau of Mines by the Air Service of the Army. An area of 336 square miles was photographed. The pictures were taken from an elevation of 15,000 feet above sea level on films 100 feet in length. It required in the neighborhood of 450 pictures and 16 hours flying time to cover the area. Some of the richest oil bearing reserves on the public lands of the United States are included in this area.

A Veteran Pilot

Probably the oldest aviator in the world, Colonel C. C. Dickinson of Chicago, 62 years old and a pilot, recently left Washington en route for Chicago on the last leg of a remarkable flight. The Colonel, in his Laird-Swallow aerial knockabout, flew from Chicago to the recent Aviation Meet at Detroit and, following the Pulitzer Trophy Races, hopped off for a trip to Florida, stopping over one day on the return flight to visit the National Headquarters of the National Aeronautic Association in this City.

Colonel Dickinson, then 50 years of age, was taught to fly in 1910 by the famous British pilot, Claude Grahame-White, who visited this country for the Gordon-Bennett aerial races of that year. Since that time the Colonel has been an aeronautical enthusiast and a supporter of the progress of commercial aviation in this country. He took an important part in the deliberations of the Detroit Aeronautical Congress, and was a much interested observer of the Pulitzer Races.

On reaching Chicago Colonel Dickinson will have completed an aerial tour of 3,510 miles which, for a man of his age, might seem remarkable, but the Colonel considers it nothing unusual in view of the present reliability of American aircraft, and the luxurious comfort of traveling by air.

Amundsen Plans Flight for May

Captain Roald Amundsen plans his flight Wainwright, Alaska, across the north pole next May or June, according to Captain C. S. Cochran of the Coast Guard cutter Bear, which was in Seattle recently after a long voyage into the Arctic Ocean. Captain Amundsen, who left here in the schooner Maud in June, spent much time aboard the Bear in the arctic. Ice in the arctic is the worst since 1906, Captain Cochran reports. Captain Amundsen intends to go to Nome, Alaska, this Winter by dog team, and to return to Wainwright for his flight with Lieutenant Oskar Omdahl, he told Captain Cochran.

Aeronautical Safety Code

In accordance with a request from the Sectional Committee for the American Aeronautical Safety Code, the National Aeronautic Association of U. S. A. has appointed its Vice-President, Bernard H. Mulvihill, and Col. Harold E. Hartney, its general manager, as members of the Committee.

This Committee today finished its deliberations at the U. S. Bureau of Standards, Washington, D. C., where, for the last two days, together with various Subcommittees, it has been formulating an Aerial Safety Code which shall be a basis for the manufacturers and operators of aircraft in this country to introduce into their activities every measure of safety which engineering practice and operating skill can devise. The whole object of this aeronautical code is to standardize and codify, for the use of such manufacturers and operators, the best possible methods which aeronautical knowledge, at this stage of development, can produce, in exactly the same manner as the manufactures of electrical equipment, automotive engines, and other mechanical industries employ safety codes.

The Sectional Committee is headed by H. M. Crane, M. E., Chairman, formerly of the Wright Aeronautical Company; Dr. J. S. Ames, Head of the Mechanical Engineering Department, Johns Hopkins University, and Member of the National Advisory Committee for Aeronautics, Vice-Chairman; Dr. M. G. Lloyd, E. E., of the Bureau of Standards, Secretary; and Mr. Arthur Halsted, E. E., of the Bureau of Standards, Assistant Secretary. The representation on the Committee are prominent members of the following organizations:—

National Aeronautic Association of U. S. A., Inc., Manufacturers Aircraft Association, Aero Club of America, U. S. Bureau of Standards, Society of Automotive Engineers, American Society of Safety Engineers, U. S. Post Office Department, National Aircraft Underwriters Association, U. S. Weather Bureau, American Institute of Electrical Engineers, National Safety Council, Underwriters Laboratories, U. S. Coast Guard, Rubber Association of America, Ameri-

can Society of Mechanical Engineers, American Society for Testing Materials, U. S. War Department, and the U. S. Forest Service.

The working out of the safety code has been placed in the hands of special Committees—viz.,

Sub-committee on Airplane Structure.—Dr. E. P. Warner, Supervisor of Aeronautics, Massachusetts Institute of Technology, Chairman.

Sub-committee on Power Plant.—George J. Mead, Wright Aeronautical Corporation, Chairman.

Sub-committee on Equipment and Maintenance of Airplanes.—Archibald Black, New York City Aeronautical Engineer, Chairman.

Sub-committee on Lighter-than-Air Craft (Balloons, Airships, Parachutes).—Ralph H. Upson, Aeronautical Engineer, Detroit, Michigan, Chairman.

Sub-committee on Airdromes and Traffic Rules (Landing Fields, Airports, Traffic Rules, Signals, Qualifications for Pilots).—Arthur Halsted, Associate Electrical Engineer, Bureau of Standards, Washington, D. C., Chairman.

This Committee has practically completed the codification of safety rules for all of the activities covered by the Subcommittees, which has been a monumental work, but will be undoubtedly the basis for complete co-operation between all agencies engaged in every phase of aeronautics in making air navigation safe, not only from the standpoint of the pilot, but of passengers and public and private property. It has been felt by all these engineering societies that a safety code should grow up with the development of the industry which can be used by aeronautical and operating companies, manufacturing companies, and even by municipalities and states in formulating regulations covering the manufacture and use



John Prest, Vice-President of the First National Bank, San Antonio, who journeyed from New York to San Antonio, Texas in a Sperry Sport Plane.

of aircraft within their jurisdiction. In this way there will be uniform measures taken, rather than disjointed and conflicting laws, regulations and rules promulgated by forty-eight states, and no one knows how many municipalities.

This activity of the Committee is not an effort to force upon aeronautics discriminatory and retarding rules, but to assist in the development of the science in America in such a way that public confidence in the safety of air navigation will be built up, and that the code itself will be one contributing effort in placing "America First in the Air."

J. V. Martin Patents

Important to those interested in aeroplane efficiency:—The Jas. V. Martin aeroplane patents—

Retractable Chassis June 17th, 1919—May 30th, 1922 and Oct. 3rd, 1922—others pending.

Aeroplane Transmission, Mar. 3rd, 1914 Paul Zimmermann and July 4th, 1922 to J. V. Martin others pending.

Internal contained shock absorber wheel, Oct. 24th, 1922, others pending, etc. Martin Aeroplane Factory, Garden City, N. Y.

Plane to Carry Sportsmen on Hunt in Arctic

Six sportsmen intend to leave this city next summer by flying boat for a hunting trip in the northern Hudson Bay region of Canada. The arduous journey afoot and by canoe through a wilderness swarming with mosquitos will be avoided and they expect to pass not more than seventy-two hours in actual travel, although the time consumed by the journey will be much longer, owing to stopovers.

The men who will make the trip are I. M. Upperco, president of the Detroit Motor Car Company of New York; Howard E. Coffin, vice-president of the Hudson Motor Car Corporation and president of the National Aeronautic Association; Harold H. Emmons, president of the Detroit Board of Commerce; Dr. James W. Inches, Police Commissioner of Detroit; William E. Metzger, president of the Detroit Club, and Charles F. Redden, president of the Aeromarine Airways, Inc.

The Aeromarine Airways, Inc., is building for the trip a flying boat which will be equipped with beds, an electric range and radio. The observation compartment in the bow will be completely inclosed. The wingspread is to be 104 feet and two 400-horse-power Liberty engines, capable of making 100 miles an hour, will be installed. The machine will weigh seven and a half tons. The hull and cabin of the boat are almost finished.

The Canadian government has given its approval to the flight, and arrangements have been made with the Hudson Bay Company for the use of its posts as service stations. Montreal probably will be the first stop. Thence the voyagers will fly westward to the Ottawa River which, with a chain of lakes, provides a water thoroughfare to James Bay, a southerly arm of Hudson Bay. The route thereafter will lie across Hudson Bay.

Virtually the entire route is above waterways, which will facilitate landing in case it becomes necessary.

"The idea of flying to the Hudson Bay district came to me recently," said Mr. Redden, "when I was flying over the Province of Quebec. I was impressed with the fact that there are innumerable lakes and rivers affording an almost continu-

ous waterway and landing field from New York to the Arctic Circle.

"Upon further investigation I found that traveling by dogsled or canoe, according to the season, a trip to the Hudson Bay region takes from six to eight weeks, and this means six or eight weeks of hardship too strenuous for any but the most experienced woodsmen.

"This led to the thought that inasmuch as the Wall Street banker and business man was going to the ends of the earth seeking new amusements it would be a good idea to take a party of sportsmen from New York into this northern territory."

Aeromarine Opens Southern Air Routes.

The first flight of the 1922-1923 season between Key West and Havana was made November 8th by the aeromarine 11 passenger flying boat SANTA MARIA. On the initial flight, the SANTA MARIA carried eleven passengers including C. F. Redden, president of the Aeromarine Airways, Inc., and Major B. L. Smith, General Manager.

On their arrival in Havana, the party received an enthusiastic reception. Prior to the reception, the president of Cuba had

designated the Cuban Secretary of War Secretary of the Navy and the Secretary of State as his representatives and after the arrival of the SANTA MARIA these officials accompanied by C. B. Hurst, American Consul General in Havana made a flight in the SANTA MARIA above Havana and circled Morro Castle several times.

Mr. Redden made public in Havana the fact that the Aeromarine Company had already made plans to inaugurate a regular schedule from New York direct to Miami in the winter of 1923.

"We have had this service under consideration for the past two years and we have proved that we can take passengers aboard in New York after breakfast and get them into Miami in time for supper. This will be possible by relay work. For instance, one of our big 11-passenger air cruisers will go down the coast half way and there at some convenient airport, the passengers will be transferred after lunch into a second aeromarine flying boat which will continue on down the coast."

The SANTA MARIA is the queen ship of the Aeromarine Airways' Black Tail Fleet. During this past summer the SANTA MARIA was one of a fleet of four 11-passenger enclosed cabin flying boats operating between Cleveland and Detroit on a double daily schedule.

Aero Club of Pennsylvania

The stated monthly meeting of the Club was held at the Air Field at Media, Pa., on October 21st. A large number of the members were in attendance. It was announced to the members that the Aero Club of Pennsylvania was represented at the recent Aero Congress by W. W. Kellett, a director of the Club.

The following pilots entered the Detroit races as Service Members of the Club. Captain St. Clair Streett, Lieutenant E. C. Whitehead and Lieutenant C. L. Bissell.

One of the important subjects which was discussed at the meeting was a method of making a drive for new members. It is felt that there are many people in and near Philadelphia, who are either directly connected with the industry or who are interested in aviation who would join the Club if same was brought to their attention. It is important that we make an effort to enroll them in order to give them the opportunity and benefit of our Aero Club associations, and direct contact with the National aeronautic development and flying events.

Plans are being made so that at sometime in the near future, inspection trips will be arranged for members of the Aero Club to go through both the Naval Aircraft Factory at League Island and the dirigible hangar at Lakehurst, N. J., where the ZR-1 is under construction. Trips of this nature will do much to arouse interest and will give the members an opportunity to see the very latest in aircraft development.

Philadelphia must quickly develop a municipal landing field for airplanes if it does not desire to fall behind other large cities of the country, and eventually be passed by when the development of commercial aviation becomes more general. This is the substance of the recommendation made to the Philadelphia Chamber of Commerce by C. T. Ludington, delegate of the local body to the Second National Aero Congress in Detroit from which

Mr. Ludington lately returned. W. Wallace Kellett, a member of the Chamber of Commerce Aviation Committee also attended the meeting. Mr. Ludington pointed out that Boston, Chicago, Kansas City and now Pittsburgh are providing landing facilities. A suitable landing field is an absolute necessity in Philadelphia.

The Media Air Field on which the club met on October 21st contains over one hundred acres and was turned over to the United States Government by the Media Business Men's Association to be used for military aviation purposes. Over twenty-five planes joined in the exhibition featuring the ceremonies. Governor Sproul addressed the 4000 persons who had gathered at the field to witness the dedication.

The Governor congratulated the business men's organization on its industry and public spirited interest. C. Frank Williamson, president of the association made the presentation. It had been expected that General Mason Patrick, head of the United States Army Air Service, would be on hand to accept the field as one of a series for army use. He was unable to attend and in his absence Major Brooks of Mitchell Field accepted the aviation field for the army. The flying field is on the Baltimore pike east of the borough of Media. It will be the western airgate of Philadelphia and is on the air route from Washington to Long Island. Planes were flown from Mitchell Field, Aberdeen and Bolling Field, Washington. More than two hundred army pilots took part in the event.

The army blimp, the D3 was anchored on the field and aroused much interest. Many types of planes including DH-9, DH-4, a Martin bomber, JN-4 and a Curtiss Oriole were on the field. Most of the planes used by the army pilots were driven by the famous Liberty motor. Following the official dedication the planes again took the air and gave an exhibition of formation and stunt flying. Later in

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THE AIRCRAFT TRADE REVIEW

Aeromarine Airways Making Remarkable Progress

A communication received from the Aeromarine Airways states that its New York Division during the period commencing May 14 and ending October 22, 1922, carried 2,380 passengers, and that the Great Lakes Division, operating between Cleveland and Detroit, in the period commencing July 17 and ending September 17, 1922, carried 1,873 passengers. These figures are exclusive of crews. It is further stated that in 2½ years, the Aeromarine Airways carried over 17,000 passengers and covered more than 1,000,000 passenger miles, without a single serious mishap or injury to the passengers; also that during the past summer they had investigators in Europe who reported that, as far as comfort goes, Aeromarine flying boats are superior to any type of aircraft now operated on the European air lines.

In conclusion, it is stated that, so far as flying boat travel is concerned, the United States leads all foreign countries.

Taught to Fly in One Day

On September 22nd, 1922, Kenneth M. Lane, a student of the Dayton Wright Airplane Company, and who had never previously touched the controls of a plane, started to take instruction early in the morning, and that evening made his first solo flight. His total instruction time was four hours and twenty-six minutes, the remainder of the day being spent in ground instruction and resting.

The purpose of this experiment was to demonstrate the advantage of teaching and the superior flying qualities of the Dayton Wright "Chummy," a plane designed primarily for training, by Colonel V. E. Clark, chief engineer of the company and well known in aviation circles. The decision to conduct such a test was made as a result of numerous inquiries from prospective students as to how many days it would require to learn to fly.

Mr. Lane, who is 26 years of age, was chosen for the test because of two qualities which he possessed; education and an interest in athletics. The nature of his education was such as to develop mental alertness, while participation in athletics had developed the endurance necessary for the long day's grind.

The instructor, Walter E. Lees, since he started flying in 1915, has tested and instructed on many types of planes. The method of instruction employed has been worked out as a result of long experience and is a feature of this training school.

The plane itself is a two side by side seated biplane with a LeRhône rotary engine of 80 horse-power. It is ideal for such work because of excellent flying qualities and the side by side seating arrangement which enables the instructor to observe the student continuously and conveys greater confidence to the student, because he knows at all times just what is happening and is told at the very moment why it happened.

Lieut. W. H. Brookley of McCook Field was official observer for the day, and Mr. C. F. Kettering, Mr. H. E. Talbot, Colonel Clark and others were

interested observers that evening when Mr. Lane made his solo tests.

The Dayton-Wright Suit

In connection with the statements issued to the press at Washington to the effect that the Department of Justice has commenced suit against the Dayton Wright Airplane Company for the sum of \$2,408,267.41 alleged over-payment by the Government on contracts for aircraft production, H. E. Talbott, Jr., President of the Dayton Wright Airplane Company today issued the following statement:

The officials of the Dayton Wright Airplane Company wish particularly to emphasize the following points as to which there can be no truthful denial:

First, the contracts in question were formulated by the Government itself;

Second, they were performed under the Government's supervision and strictly as required by it;

Third, all payments made were voluntarily made by the Government upon the basis of its own accounting and its own interpretation of the contracts;

Fourth, a settlement contract was entered into after the conclusion of the work and after an audit of the accounts;

Fifth, no complaint of any description was made by any representative of the Government for seventeen months after this settlement had been made;

Sixth, no complaint of overreaching or fraudulent conduct or falsification of accounts has ever been made;

Seventh, and lastly, the Company paid to the Government approximately seventy per cent of its profits in excess profits and income taxes, a payment for which, of course, no credit is given either in the

Government's statements or in its bill.

This suit, so far as anyone connected with the Dayton Wright Airplane Company knows, concerns in all of its important aspects merely the interpretation of the contracts under which the Dayton Wright Airplane Company turned out a great number of airplanes and spare parts for the Government during the war. All of these contracts were formulated by representatives of the War Department.

During the entire time of production under the contracts referred to, the Government representatives approved all purchases, inspected all material received, audited and approved all invoices and payrolls, and before the company could be reimbursed by the Government it had to procure a voucher signed by the Government Officer in charge.

Upon the termination of the contract a final audit of the accounts was made by Government representatives, who allowed or disallowed the claims presented by the Company, and a final settlement was made in June, 1919, evidenced by a termination or settlement agreement dated June 11, 1919, duly signed by both parties and approved by the War Department Claims Board, Air Service Section, on June 23, 1919.

During the latter part of the year 1919 and the early part of 1920, an Accountant representing the Liquidation Division of the Air Service, with a number of assistants, visited the Company's office and spent several months checking the records of the Company. On November 4th, 1920, seventeen months after settlement, the Company was notified of the action of the War Department Claims Board, Air Service Section, claiming overpayment by the



Instructor Walter E. Lees, and student Kenneth M. Lane who was taught to fly in a day.

Government of \$2,554,383.27, based on the general claim that certain of the contracts and contract provisions and the appraisal of the plant on termination of the contract were wholly or in part invalid in law, and the further claims that certain overhead items—principally special depreciation, representing the difference between cost of plant constructed for the purposes of the contract and the appraised commercial value of the plant at its completion (which value was fixed by a board of appraisers appointed one by the Company, one by the Government and the third by the two so appointed)—were improper charges to the cost of the 3500 planes and large quantities of spare parts produced by the Company.

These payments and the appraisal had been made according to the provisions of the contracts between the Government and the Company and approved as fair and reasonable by the Government representatives who made the final audit and settlement in 1919.

The Government contentions, so far as they have been explained, are without exception based either upon pure technicalities or upon forced and finespun constructions of language which never occurred to anyone as intended by the parties or as possible until long after the contracts had been performed and settlements made. No claim of undue delay, poor work, overreaching, falsification of accounts or fraudulent conduct of any kind has ever been made by the Government.

Upon completion of the settlement the Company, having no reason to suspect that the Government officials would endeavor to upset the settlement contract, had made the regulation Income and Excess Profits Tax Return, and had paid approximately seventy per cent of the profit in taxes, so that in the event the Government should be successful in proving in court its claim that these contracts, properly executed by duly authorized officers of the Government, are invalid, and that the Board of Appraisers did not properly perform their duty, the Company would have a valid offset for seven-tenths of the amount claimed.

Regarding the assertion that the Board of Appraisers did not value the property at its commercial value, the Company has been unable to obtain from the War Department Claims Board or from the Department of Justice any intelligible explanation of its reason for this or, for that matter, of any other of its findings.

It is a fact, however, that both before and after the appraisal, it gave the Government a written offer to sell the Moraine property, the principal plant, to the Government at the appraised value, and this offer, which was not accepted, remained open for acceptance by the Government from March, 1919; to October 15th, 1919.

The Dayton Wright Airplane Company welcomes the suit threatened by the Government as the only way to arrive at a final disposition of the matter, being assured by its Counsel that its interpretation, being the interpretation placed upon the contracts by the Government Officials during the entire period of their performance, is correct. The Company feels equally assured that the later action of the War Department Claims Board and the Department of Justice, which, without explanation to the Company, attempts to rescind the action of the same Board taken a number of months earlier, is wholly without justification.

UNITED STATES POST OFFICE DEPARTMENT

AIR MAIL SERVICE

Consolidated Report of Operation

Fiscal Year 1922

Month	Gasoline Cost	Grease and Oil	Repairs and Accessories	Misc.	Motocycles and Trucks	Heat, Power and Telephone	Light Office and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing and Experiments College Park	Radio	Departmental Overhead Charge	TOTAL
July, 1921	\$ 15,314.14	\$ 3,377.71	\$ 20,312.72	\$ 9,759.07	\$ 3,966.08	\$ 1,209.05	\$ 9,304.52	\$ 5,357.08	\$ 14,636.14	\$ 13,912.18	\$ 1,253.03	\$ 9,629.07	\$ 3,021.35	\$ 109,799.11
August	14,711.17	3,513.53	20,948.11	9,014.39	4,215.42	1,205.92	8,323.45	5,374.94	14,764.20	15,008.99	\$1,253.03	5,571.22	2,882.58	106,986.98
September	13,530.82	3,332.78	18,742.45	8,690.28	3,941.77	1,725.59	9,280.02	5,415.87	14,359.58	14,773.75	763.31	5,772.40	2,709.83	102,998.45
October	13,858.03	3,065.53	25,881.52	10,924.35	3,831.34	1,332.59	10,765.41	5,749.65	15,513.58	17,493.25	743.11	10,447.26	2,900.09	122,205.51
November	12,637.50	3,060.19	26,380.19	8,480.47	4,107.96	2,530.96	10,312.85	5,769.61	14,903.85	17,464.04	656.24	8,193.56	2,000.09	117,417.83
December	12,116.94	2,717.64	31,513.17	7,868.73	5,050.69	2,920.92	10,339.83	5,809.06	14,666.63	14,705.01	604.78	6,955.35	2,795.95	118,264.70
January, 1922	11,352.66	2,385.52	32,545.25	8,630.80	3,792.09	2,777.50	10,240.43	5,321.59	14,027.53	15,119.68		8,082.82	2,877.20	116,553.07
February	9,835.57	1,949.59	13,642.05	6,714.21	2,757.73	2,962.59	10,425.79	5,133.58	13,338.58	11,374.75		5,893.75	2,706.14	86,898.29
March	11,835.47	2,349.07	17,027.91	7,100.15	3,013.69	2,489.19	9,598.74	4,853.36	14,601.21	14,662.97		5,750.16	2,603.02	95,884.94
April	10,786.45	2,079.33	7,645.68	5,198.51	2,893.19	1,926.09	9,938.24	4,500.51	14,235.24	12,633.27		5,404.52	2,825.02	80,066.05
May	11,531.44	2,225.10	6,334.90	4,942.35	2,650.78	1,823.19	9,533.66	4,298.46	14,757.65	12,993.87		5,537.32	2,962.50	79,611.22
June	11,313.14	2,221.25	5,760.48	4,869.82	4,052.35	1,726.86	9,670.92	1,800.00	14,632.61	13,150.11		6,189.99	3,093.33	78,480.86
TOTAL	\$149,027.30	\$32,177.24	\$226,735.18	\$92,193.13	\$43,672.29	\$24,830.45	\$117,933.86	\$59,583.71	\$174,406.99	\$172,891.87	\$4,020.47	\$83,427.42	\$34,267.10	\$1,215,167.01

UNITED STATES POST OFFICE DEPARTMENT

AIR MAIL SERVICE

Consolidated Statement of Performance

Fiscal Year 1922

Month	Trips Possible (Scheduled)	Trips Attempted	Trips De-faulted	Trips Un-completed	Trips Weather	Trips Encountered	Mileage Possible (Scheduled)	Miles Traveled	Ferry and Test	Miles	Percent Mileage	Cost of Service	Forced Landings due to Mechanical Causes
July	624	623	1	6	65	558	131,450	130,555	18,129	148,684	99.31	\$ 109,799.11	34
August	693	689	4	13	129	560	136,974	130,555	14,893	148,684	98.22	106,986.98	32
September	657	651	6	8	180	471	127,706	127,914	22,185	148,099	98.59	102,988.45	13
October*	714	707	7	7	166	541	140,080	138,579	20,212	158,971	99.05	122,205.51	23
November	633	633	39	46	285	348	131,520	117,529	25,616	143,145	89.36	117,417.83	17
December	726	660	66	37	266	394	142,240	125,416	15,840	141,256	88.17	118,264.70	42
1922	699	633	66	32	191	442	136,880	119,966	17,721	137,687	87.64	116,553.07	31
January	635	558	77	15	210	348	124,960	110,140	10,140	118,084	86.38	86,898.29	24
February	729	690	39	22	269	421	144,720	134,503	16,161	150,664	92.94	95,884.94	13
March	675	652	23	16	276	376	134,000	127,634	6,369	134,003	95.25	20,066.05	17
April	694	694	23	8	235	459	139,360	136,973	12,312	149,285	99.30	122,205.51	23
May	702	697	5	1	161	536	139,360	138,185	9,770	147,955	99.15	79,611.22	17
June	8,228	7,887	341	211	2,433	5,454	1,629,250	1,537,927	189,338	1,727,265	94.39	1,224,723	281
TOTAL	8,228	7,887	341	211	2,433	5,454	1,629,250	1,537,927	189,338	1,727,265	94.39	\$1,215,167.01	479

* Temporary Service from Elko to Ely, Nevada, inaugurated October 19, 1921.
** Last day service on Elko-Ely route, February 15, 1922.
PAUL HENDERSON, Second Assistant Postmaster General.

ARMY *and* NAVY AERONAUTICS

Army Pilot to Try for New Record.

Brigadier-General William Mitchell, assistant chief of the Army Air Service, has recommended to his chief, Major General Mason M. Patrick, that the National Aeronautic Association of U. S. A. through the Secretary of its Contest Committee, B. Russel Shaw, at once arrange the details for officially timing and recording the flights of two Army pilots in a speed contest the intention of which is to better the world's record for airplanes over a one-kilometer course. The pilots designated for the contest are Lieutenants Russell L. Maughan and Lester J. Maitland, winners of the first and second places in the Pulitzer Race recently held at Detroit.

General Mitchell himself is the present holder of the world's record which the new contest is expected to exceed, having piloted an Army-Curtiss Race at Detroit, on October 16, at the rate of 224.38 miles an hour over a straight-away course of one-kilometer. The General used the plane flown by Maitland in the Pulitzer Race and, following his record flight, tested the plane for maneuvering, afterward testing the other plane, piloted by the first-prize winner, Maughan, in the Pulitzer Race, in the same manner, that is, looping, barrel-spinning, tail-spinning, and climbing.

These tests, together with the fact that in the Pulitzer Race Maughan had flown his plane 250 kilometers over a closed course at an average speed of 206 miles an hour, and Maitland in his had averaged 203 miles an hour over the same course, the General states, led him to believe that with minor adjustments to wings and engines these planes would be capable of even greater speed performances than those made at Detroit.

In accordance with this belief, the General has recommended the new trials, and,

while the two pilots may use any plane they may desire, it is a foregone conclusion they will select the two racers used at Detroit. Consequently, while arrangements are being completed between the Contest Committee of the National Aeronautic Association and the Army Air Service for staging the contest, the two planes in question will be overhauled and put into top-notch condition by Air Service mechanics.

Army Considering Round the World Flight

Tentative plans for an attempted flight of army airplanes around the world have been under consideration for some months by Air Service officials, it was recently learned, but the project has not as yet passed the preliminary survey stage.

Valuable data on available routes in both directions have been obtained, however, and ultimately it is hoped to send a considerable aerial squadron on the voyage. The project will not be laid before Secretary Weeks for approval, it was said, until it takes much more definite form. Two of the routes considered are that from the Atlantic coast via Iceland and Ireland, and that from the Pacific via Alaska, the Aleutian Islands, Siberia and home via Ireland and Iceland.

Air service officials said the route offering the most favorable conditions as to prevailing winds would be selected, should the flight be ordered, and it would then become necessary to obtain permission of each of the countries to be traversed before the squadron could start.

Army flyers conceived the world circling flight plan in line with the reasons which prompted President Roosevelt to send the fleet around the world in 1908, it was said. It would have value both as a step in providing aerial defense through training and in giving the world a better

understanding of American post-war developments.

Flyers of other nations have undertaken, up to this time without success, world girdling flights, but only with a single plane, while the American air service project would call for a fleet of aircraft and careful preparations involving considerable expenditures.

Study of Taking Off and Landing

One of the best known systems of flight instruction leave "taking off" and "landing" until the last, until even the acrobatics have been completed. One authority states that the majority of all accidents are caused in getting away or in returning to earth.

Mr. Carroll has prepared a study which is to be published by the N.A.C.A. In this he points out that here is a determining guide to the efficiency of any pilot. His ability in landing and taking off is a direct index of his efficiency and, perhaps, his longevity.

Two of the new instruments developed by the N.A.C.A. were used in his work—the accelerometer and the control position recorder. These show on a photographic film the complete record of the shocks sustained by the airplane in pancake and in perfect landings. The other instrument shows in the same manner the simultaneous operation of the ailerons, rudder and elevator in the operation of leaving the aerodrome or returning to it.

The author says of the application of these instruments: "They reveal to even the skilled pilot startling facts as to his technique. It is surprising to see an accurate record of his every movement of the controls in the air and the fluctuation of the loading and air speed which have given him but fleeting impressions while he was in the air."

Up to the time of the development of these and other recording instruments by



New type of Navy Seaplane that can be operated from the deck of Submarines

Harris & Ewing

the N.A.C.A., designers and engineers had to depend much upon the memories of test pilots as to the performance of a particular airplane. The pilots' recollections were often vague and they frequently disagreed as to the same airplane, due, perhaps, to the personal equation. Today, however, a review by the flier of the finished chart enables him to recall his actions, the response of the airplane, and give a comprehensive report, which frequently adds much to the delineations on the chart.

In a pancake landing, intentionally made by Carroll by levelling off about six feet or so above the ground, the record of the blow showed that the plane hit the ground with a force of 4.5 times the weight of his craft. In careful and regular landings this force seldom exceeds 1.5 to 2 times the weight of the airplane.

It will be the province of the proposed federal bureau of civil aeronautics to pass upon the fitness of pilots who may be employed in the transportation of the public. The control position recorder instrument visualizes the relative skill of pilots in the execution of any maneuver whatever. It equals the Wasserman test of the physician. The human element is a vital factor in the matter of insurance. This and other new instruments measure flying skill in figures.

Construction of New Airship At Langley Field

The erection of the Airship C-14 is rapidly nearing completion, even though several unexpected difficulties were encountered in its assembly. On "weighing off" the ship, it was found to be tail heavy, which necessitated the moving forward of the car suspensions. This did not materially alter the existing defect. The surfaces were moved forward as an alternate method of remedying the uneven distribution of weight and several patches were replaced, together with a complete reassembly of the entire fin construction. This change in plans will retard the work several days from the date originally intended for completion.

The lift of the C-14 is estimated as being several hundred pounds in excess of the C-2, due to the fact that the envelope is approximately 10,000 cubic feet over-size. The envelope is considered by the officers in charge as having a rather poor general outline, as irregularities developed in the surface when inflated.

Tests flights are being carried on, and as soon as it is deemed practicable, the ship will be flown to Aberdeen Proving Grounds on its first cross-country flight.

Tracing the Movement of Troops

The 22nd Photo Section, stationed at Kelly Field, Texas, recently cooperated in the maneuvers held by the Second Division. A mosaic map of the area occupied by the troops of the Division was made one day when the area was occupied, and another was made the following day, after the troops had been withdrawn. Very satisfactory results were obtained, it being possible to trace the movements of the various regiments almost as well as though they had built roads to move

out on, and proved to the officers of the Second Division the value of aerial photography in tracing the movements of troops. Of particular value was the proof of the ability of the K-1 camera, fitted with a K-3 filter, and using Panchromatic film, to pierce the haze so often encountered in aerial photography. The photographs were made at an altitude of 9,300 feet, through a dense haze which extended up to about 10,000 feet, and which rendered it impossible to pick out a point four miles distant with the naked eye. This point was some large, bright red building. Regardless of this disadvantage, however, the negatives obtained were clear and snappy. Captain Giffin piloted the photographic ship and Cadet Thomas made the exposure.

Towing Balls from Flying Airplanes

Adventure is introduced into drab science in the flying experiments of the National Advisory Committee for Aeronautics at Langley Field Memorial Laboratory at Langley Field, Va.

"Towing full sized wings, struts and wooden balls from a flying airplane has its ups and downs," says Thomas Carroll, test pilot for the Committee.

Renewed flights have been made to determine the comparative properties of various wind tunnels by the dragging of various sized spheres through the air at actual flight speeds. Design data has been largely based on the wind tunnel experiments in France, England, Italy, Germany and America, in which tenth or twentieth scale models have been utilized. Each of these different laboratories gives a varying figure for the same thing, and quite naturally.

By the towing of spheres through the

air, the actual conditions of flight in free air are reproduced and the results when compared with the wind tunnel figures show the relative accuracy of the work of any one tunnel.

The relation between the sphere drag in a tunnel and the drag when moving through unrestricted air has not previously been measured, due to experimental difficulties. However, the comparison between wind tunnels and actual flight is very important, for the chief use of wind tunnels is to tell us what will happen in flight; so that it is quite necessary for us to know how far the tunnel results depart from the truth.

In view of this, the N. A. C. A. set its engineers to work to devise a method of testing the drag of spheres in free air. These wooden balls are from four inches to forty inches in diameter and are suspended, when being tested, by a fine wire from airplanes in flight, with instruments to measure the angle of the wire with the vertical. Knowing this angle and the weight of the sphere, it is an easy matter to calculate the drag of the sphere itself.

These spheres are not merely just plain balls, but they must be accurately spherical and their surfaces must be highly polished, for irregularity would create eddies and give erroneous values of the drag.

The airplane must be flown horizontally and at a constant speed during these tests and this requires a skilled pilot. It is also necessary to fly when the air is smooth, else the sphere will swing about like a giant pendulum and, if care is not taken, become uncontrollable. It would be mighty unpleasant to have one of these large balls swinging about at the end of a wire, thinks Mr. Carroll.



Left to right:—G. G. Albertoni, chemical engineer who will act as interpreter; Umberto Nobile, Chief Aeronautical Engineer for the Italian government; C. H. Zimmerman, aeronautical engineer.

Taken on arrival of M. Nobile at Akron, Ohio enroute to the Goodyear Tire and Rubber Company for whom he will be consulting engineer in the construction of the giant 300 ft. semi-rigid airship soon to be built by Goodyear for the United States War Department.

REVIEW of WORLD AERONAUTICS

European Air Traffic

Traffic on the Continental airways reached a record figure during the month of August. Not only did the numbers of machines flying to and from Croydon surpass any previous monthly figure but the numbers of passengers travelling by air and the weight of goods transported also exceeded the highest totals hitherto recorded.

As compared with July, when the passengers on all routes were 1591, the August travellers increased by more than 1000, the exact number using air services being 2682. The previous best monthly figure was 2,021 in August of last year.

It is satisfactory to note that the British Companies carried the largest proportion of this traffic, their share slightly exceeding 82 per cent of the whole, while the French and Dutch Companies between them received only about 18 per cent. A year ago the British Companies' proportion was just over 45 per cent, so that there is not merely an increase in numbers but also clear indications of the preference of air travellers for British operated services. The number carried by British lines was 2,203.

The weight of air borne goods also rose to 77.8 tons, an increase of several tons on the July figures which were a record. A special feature of this traffic was that there was a daily average of slightly more than one ton of newspapers from London to the Continent during the month. Nearly the whole of the outgoing newspapers were carried by British aircraft. Incoming newspaper traffic was small in proportion, but the total newspaper traffic weighing 37.4 tons formed the largest class of goods transported by air. Other goods traffic amounted to 40.4 tons of which British and French machines each took 17 tons. Dutch aircraft carried in all 6.4 tons.

The number of machines flying on the Paris, Brussels, and Rotterdam services increased to 912 from 711 in July, a figure which was itself a record. The daily average of machines was therefore over 30. British Companies operated 598 of the total while French firms' machines numbered 210 and the Dutch Company accounted for the remainder of 104. The number of departures from the London Terminal Aerodrome, Croydon was 457 and the arrivals 455.

The efficiency of British operated machines was again very high, over 95% of the flights by British aeroplanes on the London-Paris route being completed within the stipulated period of four hours while practically 90% of the flights were made in less than 3 hours.

The percentage of useful passenger accommodation and general cargo space utilised during the month on British aircraft was 48%, which is a slight increase on the proportion during July.

The approximate distance flown by aircraft during the period was 185,000 miles, of which 115,000 miles were covered by British machines. On the London-Paris route, British and French machines flew 132,000 miles, while 30,000 miles were covered between England and Belgium, and 23,000 on the London-Rotterdam route.

There were no casualties or injuries to passengers or crews during the month.

French Airships Must Have Certificates of Navigability

Airships were moved a degree further toward receiving the same treatment as warships by the publication Oct. 22 of a decree in the Official Journal dealing with their certificate of navigability.

The decree, which came into force Nov. 15, declares that the certificate of an airship remains in force only so long as it possesses a rating certificate from the Bureau Veritas, which is the French equivalent of Lloyd's, certifying that the technicians of the Veritas Bureau have found the airship in a good state of navigability.

Airship Line From Sevilla to Buenos Aires

According to articles appearing in the current press, the proposed airship line from Sevilla, Spain, to Buenos Aires, Argentina, will start operations in the not distant future. In Sevilla and Buenos Aires the installation of airdomes is about to be started. Three hangars will be built in Sevilla—two to house three Zepelins, and the third one to shelter a dirigible of smaller size, which will cover the route from Sevilla to the Canary Islands, carry 29 passengers, and will cost 500,000 pesetas.

Of the hangars to be constructed at

Sevilla, the largest will measure 300 by 90 by 50 meters, and will be the station shed. The other two will measure 300 by 50 by 50 and 150 by 50 by 50 meters, respectively. The first of these last two is to be used for repairs to ships, and the second to shelter the training ship. The regularity of the winds in the region is unusual, and for that reason it is expected that no serious difficulty will be encountered in landing and entering these sheds, which will be fixed in direction. On the other hand, in Buenos Aires the winds are more variable in direction and greater in velocity. A revolving shed is projected, measuring 280 by 50 by 50 meters, and another, fixed in direction. The first one can be turned in any direction, and this will facilitate the operation of landing. An alternative idea is to have a circular shed, measuring 350 meters in diameter, equipped with 16 doors.

Three of the four ships to be built will be of 135,000 cubic meters capacity, 250 meters long and 33.8 meters greatest diameter. The fourth will be of 30,000 meters capacity, 144 meters long and 21.1 meters in diameter. The big ships will carry nine motors of 400 h. p. each, mounted in independent cars. The ship will carry 40 passengers, besides the crew, and eleven tons of mail or freight. The economical speed will be 110 kilometers an hour, and the maximum speed 132. Two of the motors will be kept in reserve, and it is not contemplated that the other 7 will be in use all at the same time, except in case of heavy opposing winds.

The quarters for the pilots and officers of the ship, the saloon, the kitchen and the smoking room will be in the forward part. It is expected to make a trip in each direction each week. The western trip, it is calculated, will require 3 days and 16 hours, but the eastern trip 4 days and 6 hours, due to the fact that atmospheric conditions are less favorable. The cost of the trip will be 10,000 francs, and the round trip may be made in seven days. A mail service is to be included, and the postage on a letter from Sevilla to Buenos Aires will be 3 francs and 75 centimes.

The whole project is the idea of Major Herrera, and was worked out by him during the war. His studies indicate that the 10,000 kilometers can be easily traversed in a single flight.

After the preliminary studies and calculations were completed and reviewed, General Echague presented the project to the League of Nations, which gave it effusive praise. No action was taken, however, for various reasons, among them the fact that the Argentine Republic was not represented in the League. The King of Spain is deeply interested and enthusiastically in favor of the realization of this scheme.

The company has been formed, including among others the Senores Berreatua and Rementerias and as President, Senor Goicoechea, the former Minister. After further study in consideration of the project and the figures, Senor Goicoechea, with three of these experts, made the trip to Buenos Aires. There the Spanish project was received by the Argentine Republic and by Colonel Mosconi, Chief of



The New Type L-57 Albatros, equipped with 240 H.P. Rolls Royce engine.

the Aviation Service, with the greatest enthusiasm.

The total expenditures for material, pay of personnel, construction of the ships and of the sheds, etc., amount to approximately 100,000,000 pesetas. According to Senor Herrera, the ships will be of a new type. As shown by the experiments of the Zepelin factory during the war, no danger or difficulty is apprehended from storms. For the past five years there has not been a single accident in the daily air service in Germany.

The development of this service will be a favorable impulse to the national industry. In the beginning German pilots will be employed on these ships, and the materials of construction, including that for the frame, which is an aluminum alloy, will be imported from Germany. It is expected, however, that this material will be later produced in Spain.

A Monument to a Pioneer Aviator

There was recently unveiled at Cap Blanc Nez, France, a monument erected to the memory of Hubert Latham, the famous French pioneer aviator, who will be remembered for his flying in England in the early days of aviation, and who made two attempts before M. Bleriot to fly across the English Channel. In this he failed, and when rescued from the water on the second occasion, July 27, 1909, was calmly seated on his machine smoking a cigarette. Mr. Latham was killed in French Congo in 1912 while hunting wild buffalo.

Americans will recall this nervy little airman and his famous Antoinette monoplane in which he made several exhibition flights in this country. Natives of Baltimore, Md., no doubt still remember that eventful day, November 7, 1910, when they were thrilled by his 42-minute flight over the city for the prize of \$5,000 offered by the Baltimore SUN.

Aerial Route Between Italy and Egypt

On the arrival in Italy of one of the four large hangars of 2500 m. which Germany has to deliver to Italy, Mr. Gino BASTOGI proposes a great airship route, starting from Milan with stops at Rome—Tripoli—Bengasi and ending with Alexandria, Egypt.

The distance of Km. 540 from Milan to Rome would be made in 6 hours passing over the Giovi at little over 1000 meters and then over the water. This would be better than the entire air route which, although 50 Km. shorter would compel a greater altitude from the Piacentino mountains to the roman territory.

The distance of Km. 1020 between Rome and Tripoli would take about 10 or 11 hours; all maritime route, therefore the best. At present it takes 3 days from Rome to Tripoli and four days from Milan.

The distance of 680 Km. Tripoli and Bengasi could be made in seven hours, great advantage in comparison with the present means of communication, exclusively maritime and therefore five times slower than the airship.

The last lap of Km. 980 from Bengasi to Alexandria would take 10 hours; following the coast, with a short flight across the Cyrenean plateau with elevation of not more than 300 m.

The chronological advantage of the route would be reached at Alexandria,

Egypt; where there are many rich Italians who come often to Italy for business or pleasure, making the trip on fast steamers which take 5 days to Rome or Milan, costing about Lire 4000 while with the proposed aerial route would take less than 2 days and would cost Lire 2500 and little more for the food.

Beside the Italians and Egyptians, everybody going to and from Europe and further than Suez Canal, will take advantage of the three days gain offered by the aerial route, as Milan is the crossway of all the fast railroads leading to France, England, Belgium, Holland and Germany.

Even the mail, all of it, or the stamped, could be carried with profit: 10,000 letters could easily find place on board, without disturbing the passenger's baggage and special merchandise.

There will be room for 30 passengers and the speed would be from 90 to 110 Km. corresponding to half of the power. The speed of 125 Km. which can be developed constitutes a remarkable margin to make up for delays or for climbing up to 10 m. per second.

A Prize for Papers on Airships

The Council of the Royal Aeronautical Society have decided to institute forthwith from the funds of the R.38 Memorial Research Fund, an annual prize for a technical paper on Airships. The regulations covering the award of this prize are given below, from which it will be seen that the date for the receipt of the names of intending competitors for the first award is December 31st, 1922, while the papers themselves must reach the Secretary on or before March 31st, 1923.

From the income of the above Fund, a sum of twenty-five guineas will be offered annually as a prize for the best paper received by the Royal Aeronautical Society, on some subject of a technical nature in the science of Aeronautics. Other things being equal, preference will be given to papers which relate to Airships.

The prize is open to international competition. The Royal Aeronautical Society retain the right to withhold the prize in any year, if it is considered that no paper is of sufficient merit to justify an award.

Intending competitors should send their names to the Secretary of the Royal Aeronautical Society, 7 Albemarle Street, London, W.I. on or before December 31st of each year, with such information in regard to the projected scope of their papers as will enable arrangements to be made for their examination. The closing date for the receipt of papers will be March 31st in each year.

Papers should in all cases be typed, and

a copy should be retained by the Author as the Society can take no responsibility for the loss of copies submitted to it.

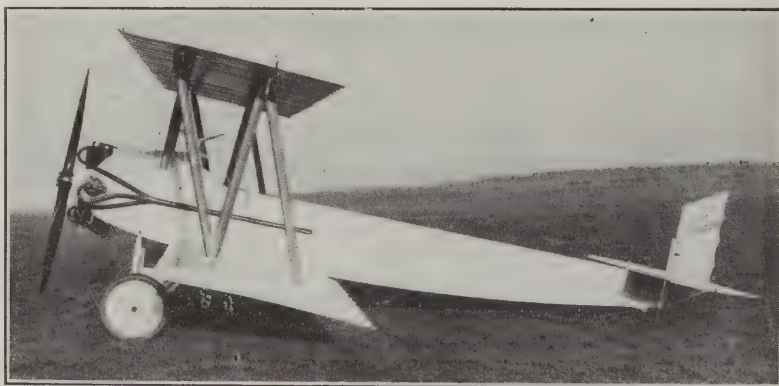
Successful papers will become the absolute property of the Society, and will in most instances be published in the Society's Journal. In regard to unsuccessful papers, the Society retains the right of publication in its Journal, but in each case will notify the Author shortly after the award, whether it intends to exercise this right: if not, the Author will be free to publish elsewhere. A signed undertaking must accompany each paper, to the effect that the publication has not already taken place and that the Author will not communicate it elsewhere until the Society's award is published. Due acknowledgment must be made by the Author of the source of any special information.

International Commission for Air Navigation

The International Commission for Air Navigation, established by the International Air Convention which governs Civil Aviation, have concluded a very successful Session in London. Sessions are held three times a year, in February, July and October, the first having taken place in Paris last July following the ratification on June 1st of the Convention signed on October 13th, 1919 in Paris.

At this Second Session the following were among the subjects discussed:—

- (1.) The amendment of Article 5 of the Convention, which prohibits, except by special and temporary authorization, the aircraft of a non-contracting State from flying over the territories of contracting States, proposed by the French delegates, was accepted in principle. This proposal is that individual agreements may be drawn up between them contracting and non-contracting States, authorizing international air communication between them provided that the general regulations of the Convention are conformed to. It will now be necessary to obtain the ratification of this amendment by the various contracting States.
- (2.) The system of voting on the Commission, which gives a preponderance of votes to certain Great Powers, and therefore has tended to discourage other States from becoming Parties to the Convention, was reviewed at the request of both the British and the Belgian delegations. The proposals for the removal of this difficulty was sympathetically received



The 1923 Model Farman 2-Seater Touring and Sport Plane. It is equipped with a 50-60 Anzani Air cooled motor.

by the whole Commission and will be explored by the several Governments before the next Session.

(3.) Minimum international standards for airworthiness certificates.

(4.) The medical examination of pilots and other air personnel.

(5.) A system under which aircraft registration letters and wireless call letters would be the same.

(6.) A revision of the regulations as to signals and log-books.

The Third Session will be held in Brussels towards the end of next February at the invitation of the Belgian Government.

Between the Sessions the Sub-Committees Operational, Wireless, Meteorological, Medical, Legal, Maps continue their activities.

Japan Institutes Aerial Mails

Flights in Japan's first air mail service, between Tokio and Osaka, a distance of 450 miles, were attended with fair success Nov. 3. The weather was perfect. The air postman flew from Osaka to Tokio in three hours. Another made the trip from Tokio to Osaka in four hours.

Commercial Aviation in South Africa

The South African Airways Co. (Ltd.), whose capital of £200,000 is being subscribed in England, has been organized to inaugurate commercial aviation in South Africa. Government assistance in the form of free training of pilots, free landing grounds, hangars and aerodromes when available, repairs and supplies at cost, as well as co-operation with the postoffice in the transmittal of letters and parcel post, is anticipated if the company attains a special status satisfactory to the Government.

It is intended at first to concentrate on the main route from Cape Town to Johannesburg, and the company hopes to commence operation by the end of 1922. This route will be worked in three relays with 12 machines having Rolls-Royce engines. After establishing the main route, it is planned to extend the service from Johannesburg to Durban, a flight of three hours. It is proposed to run a Cape Town-Johannesburg-Pretoria service once daily in each direction, and the Johannesburg-Durban service twice daily each way, except Sundays and Holidays.

Obstacles to the success of this project are the great distances and sparseness of population and in the high operating costs.—Commerce Reports.

Non-Stop Berlin-Moscow Flight

Chim Styllbrock, a German airman, recently accomplished a notable feat in aviation when he made a non-stop flight from Moscow to Berlin, a distance of 1,115 miles in 18 hours. He piloted a Fokker R-4 fitted with a Rolls-Royce engine, and carried his passengers the Russian representatives in Berlin, M. Krestinski, and two government officials. The machine traveled over the towns of Vyasma, Smolensk, Vitebsk, Polotsk, Dunaberg, Kovno, Königsberg, and thence to Berlin.

French Government Cooperation

Vice Consul John F. Simmons, Paris, in a recent issue of Commerce Reports (U. S. Dept. of Commerce) states that the French Government renders very practical assistance to airplane manufacturers in their efforts to develop new types of aircraft. The "Service Technique" outlines the type of craft desired, and any manufacturer may submit a design, according to the conditions specified. If the

manufacturer's type is selected, the firm receives a trial order; and if the craft is successful the firm receives an additional order with the assurance that no manufacturer will produce its type of craft without paying the firm a royalty. Thus each manufacturer is induced to produce original designs, as he knows that quantity orders will be given to his firm and not to a rival who, not having had to bear the cost of experimenting, might be able to underbid him.

The "Service Technique" passes on all models, the tests being made at one of the best equipped laboratories in the world, located at Issy-les-Moulineaux. These laboratories are all new and the largest wind tunnel which has yet been constructed will soon be put into operation at Issy. Aviation is also encouraged by a large number of cash prizes offered by the Government, the aero clubs, and various individuals for flying feats.

Announcement has been made by the French Aeronautical Chamber of Commerce to the effect that the Aero Show will be held at the Grand Palais, Paris, from December 15, 1922 to January 2, 1923.

New Scandinavian Record

A new altitude record for Scandinavia (23,293 feet) was recently established by Lieut. Gottenburg of the Norwegian Army Air Service, accompanied by a passenger. Both were provided with oxygen apparatus. The former record was 16,732 feet.

Airships Five Times Bigger Than Zeppelins

Engineering data now available indicates that the next commercial airship will be monstrous in size, even to seven or eight times the size of present-day airships of the German type. Practice in the building of giant airships has shown that there is continued advantage in increasing the cubic capacity of the gas containers, which means a smaller volume of gas per passenger carried, a smaller weight of fuel per passenger, which means a lower rate of transport.

Recall the Schutte-Lanz of practically 2,000,000 cubic feet capacity, 650 feet in length by 75 feet in diameter, carrying a useful load of 39 tons, driven by 1200 h. p. at a speed of 64 miles an hour.

The useful load is 58 per cent of the total. The useful load of the Junker airplane, probably one of the most efficient in this country, is 36 per cent of the total. There is no longer any argument as to the sphere of the airship for economical long-distance transportation.

It is difficult to conceive the gigantic proportions of an up-to-date air liner of 10,000,000 cubic-foot capacity.

This advantage in the continued increase in cubic contents persists as far as engineers have figured, and they have extended their calculations to ships of over 14,000,000 cubic feet of gas capacity, where nearly 3 passengers can be carried for every 39,000 feet of gas.

However, Colonel Crocco, one of the greatest authorities in airship design, a pioneer experimenter in Italian aeronautics, states that there is "an optimum value of the ratio between the useful load and the total load at about 270,000 cubic metres (9,554,490 cu. ft.), and that practically the increase of cubature beyond this limit and even up to it, hardly compensates for the greater commercial risk incurred by the concentration of tonnage."

In other words, it would be a better business proposition to operate two ships of 7,000,000 cubic feet than one of fourteen.

The General Air Service, which proposes to operate three ships between New York and Chicago, figures on craft of the moderate size of 4,000,000 cubic feet, which is twice the size of the largest airship built to date.

For a very complete bibliography of books on airships, see Army Air Service Information Circular (Aviation) No. 21, "Aeronautical Book and Magazine List," available by reference only.

Are German Aircraft Engines More Efficient?

Allied aircraft pilots who were pitted against the enemy in the World War, as well as automobile engineers and everyone looking to the economization of air travel, are interested in the test of the 185 h. p. B.M.W. and the 300 h.p. Maybach engines. These were made in the altitude chamber of the U. S. Bureau of Standards where conditions of temperature and pressure can be so controlled as to stimulate those of any desired altitude. Both engines exhibited excellent full-load efficiencies.

The economy of the B. M. W. was found "superior to most engines tested thus far, even at a density corresponding to an altitude of 25,000 feet. Its low fuel consumption is the outstanding feature of merit."

Economy of air transportation in dollars and cents of actual carrying costs is now of absorbing interest in the consideration of possible air routes. There is, too, the economy in flying at high altitudes, made possible by the supercharger and the adjustable propeller. Every ounce saved in fuel means an increase in the useful "pay load."

While the efficiency of the engine is not the whole story, it is of interest to make a comparison between the best known American-built machine, the DH4 with Liberty engine—not motor—and the German-built all-metal Junker with the B. M. W. which has been flying in America.

Characteristics

	DH4	Junker SL
No. occupants	2	4
Weight empty, lbs.	2391	2317
Useful load, inc. fuel and oil, lbs.	1191	1288
Weight loaded, lbs.	3582	3605
H.P. about 1400 r.p.m.	400	243
Useful load per h.p., lbs.	2.971	5.30
Ground speed at about 1400 r.p.m., m.p.h.	120	111
Endurance, one charge, hours	2.6	5.30

To arrive at a measure of efficiency, in a popular way, one can take the fraction 111 over 120 (speed comparison) and multiply it by the fraction 5.30 over 2.97 (load per h.p. comparison) and find that the DH4 is but 63 per cent as efficient as the Junker.

True, the DH was not built as a passenger-carrier but as a certain type of war machine. But the fact remains that we have not in this country in actual service a machine that will outstrip the B. M. W. in economy of performance.

With the present great interest in the possibility of passenger air lines and their expected stimulation through the proposed establishment of a federal bureau of civil aeronautics, the question of economy in actual cost per ton-mile is vital.

Exhaustive information on the performance of the Maybach and B. M. W. engines may be had in N. A. C. A. Reports 134 and 135.

“Technical Notes” of the N. A. C. A.

THERE has been printed in the November issue of *Aerial Age* a complete list of the printed Reports of the National Advisory Committee for Aeronautics to that date. Following is a list of the “Technical Notes” of the Committee. These are prepared in mimeographed form, frequently with photostated illustrations, but owing to limitations of funds and the processes of publication, these are not always available in sufficiently large quantities to meet any very great demand. However, they may be found in a number of libraries or may be obtained on loan from the Committee, at the New Navy Building, Washington, D. C.

These and other lists of Government documents are being printed by *Aerial Age* with the idea of making available either by possession or loan all possible information on aeronautics.

New reports and notes of the Government and new books, of course, will be noticed from time to time in the pages of this journal.

No.

- 1 Notes on Longitudinal Stability and Balance, by Edward P. Warner, N.A.C.A.
- 2 Airplane Performance as Influenced by the Use of a Supercharged Engine, by George de Bothezat, N.A.C.A.
- 3 Notes on the Theory of the Accelerometer, by Edward P. Warner, N.A.C.A.
- 4 The Problem of the Helicopter, by Edward P. Warner, N.A.C.A.
- 5 Relation of Rib Spacing to Stress in Wing Planes, by A. F. Zahm, Bureau C & R, Navy Dept.
- 6 Static Testing and Proposed Standard Specifications, by Edward P. Warner, N.A.C.A.
- 7 Notes on the Design of Supercharged and Over-Dimensioned Aircraft Engines, by Otto Schwager, Translated from Technische Berichte, Vol. III, Sec. 5, by George de Bothezat, N.A.C.A.
- 8 Duralumin, by E. Unger and E. Schmidt. Translated from Technische Berichte, Vol. III, Sec. 5, by Starr Truscott, Bureau C & R, Navy Dept.
- 9 Theory of Lifting Surfaces. Part I, by L. Prandtl, 1918. Translated from the German and abstracted by W. Margoulis, N.A.C.A.
- 10 Theory of Lifting Surfaces. Part II, by L. Prandtl, 1919. Translated from the German and abstracted by W. Margoulis, N.A.C.A.
- 11 The Problem of the Turbo-Compressor, by Rene Devillers. Extract from “The Internal Combustion Engine.” Translated from the French by Paris Office, N.A.C.A.
- 12 Recent Efforts and Experiments in the Construction of Aviation engines, by Otto Schwager. Translated from the Technische Berichte, Vol. III, No. 5, by Paris Office, N. A. C. A.
- 13 Soaring Flight in Guinea, by P. Idrac. Translated from the French, by D. L. Bacon, N.A.C.A.
- 14 Increase in Maximum Pressures Produced by Preignition in Internal Combustion Engines, by S. W. Sparrow, Bureau of Standards.
- 15 Tests of the Daimler D-IVa Engine at a High Altitude Test Bench, by W. G. Noack. Translated from Technische Berichte, Vol. III, Sec. 1, by Paris Office, N.A.C.A.

- 16 Experience with Geared Propeller Drives for Aviation Engines, by K. Kutzbach. Translated from Technische Berichte, Vol. III, Sec. 3, by Starr Truscott, Bureau C & R, Navy Dept.
- 17 Italian and French Experiments on Wind Tunnels, by William Knight, Paris Office, N.A.C.A.
- 18 The Dynamometer Hub, by W. Stieber. Translated from Technische Berichte, Vol. III, Sec. 6, by Technical Staff, N.A.C.A.
- 19 The Steadiness Factor in Engine Sets, by W. Margoulis, Paris Office, N.A.C.A.
- 20 Notes on Specifications for French Airplane Competitions, by W. Margoulis. Translated from French, by Paris Office, N.A.C.A.
- 21 Drag or Negative Traction of Geared-Down Supporting Propellers in the Downward Vertical Glide of a Helicopter, by A. Toussaint. Resume translated from the French, by Paris Office, N.A.C.A.
- 22 The Photographic Recording of Small Motions, by F. H. Norton, N.A.C.A.
- 23 Horizontal Buoyancy in Wind Tunnels, by A. F. Zahm, Bureau C & R, Navy Dept.
- 24 Development of the Inflow Theory of the Propeller, by A. Betz. Resume translated from the German, by Paris Office, N.A.C.A.
- 25 Center of Pressure Coefficients for Aero foils at High Speeds; by Walter S. Diehl, Bureau of Aeronautics, Navy Department, Washington, D. C.
- 26 A Variable Speed Fan Dynamometer, by Karl D. Woods, Bureau of Standards.
- 27 Instrument for Measuring Engine Clearance Volumes, by S. W. Sparrow, Bureau of Standards.
- 28 Loads and Calculations of Army Airplanes, by Stelmachowski Translated from Technische Berichte, Vol. III, No. 6, by Office of Naval Intelligence, U. S. N.
- 29 Progress made in the Construction of Giant Airplanes in Germany during the War, by A. Baumann. Resume translated from the German by Paris Office, N.A.C.A.
- 30 Design of Recording Wind Tunnel Balances, by F. H. Norton, N.A.C.A.
- 31 Crippling Strength on Axially Loaded Rods, by Fr. Natalis. Translated from Technische Berichte, Vol. III, No. 6, by Prof. Pawlowski, University of Michigan.
- 32 Causes of Cracking of Ignition Cable, by F. B. Silsbee, Bureau of Standards.
- 33 The Effect of the Nature of Surfaces on Resistance, as Tested in Struts, by Dr. Ing. C. Wieselsberger. Translated from Zeitschrift für F & M, Feb. 28, 1920, by Paris Office N.A.C.A.
- 34 The 300 HP Aviation Engine, by Dr. A. Heller. Translated from Zeitschrift des Vereines Deutscher Ingenieure, Paris Office, N.A.C.A.
- 35 The Optical Wing Aligning Device of the Langley Field Tunnel, by F. H. Norton, N.A.C.A.
- 36 N.A.C.A. Langley Field Wind Tunnel Apparatus. The Tilting Manometer, by F. H. Norton, N.A.C.A.
- 37 The Determination of the Effective Resistance of a Spindle Supporting a Model Aerofoil, by W. E. Davidson and D. L. Bacon, N.A.C.A.

- 38 Measurements of Rudder Moments on an Airplane During Flight, by Ing. V. Heidelberg. Translated from Zeitschrift für F & M, Vols. 21 and 22, by Paris Office, N.A.C.A.
- 39 High Thermal Efficiency in Airplane Service, by S. W. Sparrow, Bureau of Standards.
- 40 Effect of the Reversal of Air Flow upon the Discharge Coefficient of Durley Orifices, by Marsden Ware, N.A.C.A.
- 41 Influence of Span and Load per Square Meter on the Air Forces of the Supporting Surfaces, by A. Betz. Translated from Technische Berichte, Vol. I, Sec. 4, by Lt. Diehl, Bureau C & R, Navy Dept.
- 42 The Determination of Downwash, by Lt. Walter S. Diehl, Bureau C & R, Navy Dept.
- 43 Note on the Resistance of Polish Cylinders (and Cylindrical Wires with Generatrices Perpendicular to the Air-stream, by A. Toussaint. Translated from the French by Paris Office, N.A.C.A.
- 44 On the Resistance of Spheres and Ellipsoids in Wind Tunnels, by I. P. Riabouchinsky. Translated from Bulletin of the Aerodynamical Institute of Koutchino, by Paris Office, N.A.C.A.
- 45 Extract from a Report on the Resistance of Spheres of Small Diameter in an Airstream of High Velocity, by Capt. Toussaint and L. Hayer, Translated from the French by Paris Office, N.A.C.A.
- 46 Theory of the Ideal Windmill, by Wilhelm Hoff. Translated from the German by Paris Office, N.A.C.A.
- 47 Recent European Developments in Helicopters, prepared by Paris Office, N.A.C.A.
- 48 Airplane Superchargers, by W. G. Noack. Translated from Zeitschrift des Vereines Deutscher Ingenieure 1919, page 995, by Office of Naval Intelligence, Navy Dept.
- 49 On the Resistance of the Air at High Speeds and on the Automatic Rotation of Projectiles, by D. Riabouchinsky. Translated from the French by Paris Office, N.A.C.A.
- 50 The Gordon Bennett Airplane Cup 1920, by W. Margoulis, N.A.C.A.
- 51 Airplane Balance, by L. Hugues. Translated from “La Vie Technique and Industrielle,” May, June, July, 1920 by Paris Office, N.A.C.A.
- 52 A New Method of Testing Models in Wind Tunnels, by W. Margoulis, N.A.C.A.
- 53 Similitude Tests on Wing Section by H. Kumbruch. Translated from the German, by D. L. Bacon, N.A.C.A.
- 54 The Factors that Determine the Minimum Speed of an Airplane, by H. Norton, N.A.C.A.
- 55 Airplane Crashes; Engine Trouble A Possible Explanation, by S. W. Sparrow, Bureau of Standards.
- 56 The Development of German Airplanes During the War, by Wilhelm Hoff. Translated from Zeitschrift des Vereines Deutscher Ingenieure, 1920, P.493, by Office of Naval Intelligence, Navy Dept.
- 57 The Caproni Seaplane, by Max Munk, N.A.C.A.
- 58 Absolute Coefficients and the Graphical Representation of Aerofoil Characteristics, by Max Munk, N.A.C.A.
- 59 The Dynamometer Hub for Testing

Propellers and Engines During Flight by O. Enoch. Translated from Zeitschrift für F & M, Vol. X, No. 19, by Paris office, N.A.C.A.

60 On a New Type of Wind Tunnel, by Max Munk, N.A.C.A.

61 Performance of a Vane-Driven Gear Pump, by R. H. Heald, Bureau of Standards.

62 The Problem of Fuel for Aviation Engines. Lecture given by Prof. Kutzbach, of Dresden, Scientific Collaborator of the Adlershof Aeronautical Laboratory. Translated by Paris Office, N.A.C.A. Edited by W. S. James, Bureau of Standards.

63 The Employment of Airships for the Transport of Passengers, by Umberto Nobile. Translated from Giornale dei Genio Civile, Anno LIX, 1921, by Paris Office N.A.C.A.

64 N.A.C.A. Recording Air Speed Meter, by F. H. Norton, N.A.C.A.

65 Langley Field Wind Tunnel Apparatus, by D. L. Bacon, N.A.C.A.

66 Göttingen Wind Tunnel for Testing Aircraft Models, by L. Prandtl. Translated from Berichte und Abhandlungen der WGL, Sept., 1920, by N.A.C.A.

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73 The Choice of Wing Sections for Airplanes, by Edward P. Warner, Secretary, Committee on Aerodynamics, N.A.C.A.

74 Mutual Influence of Aerofoil and Propeller, by L. Prandtl. Translated from Ergebnisse der Aerodynamischen Versuchsanstalt zn Göttingen, by N.A.C.A.

75 Effects of Varying Relative Vertical Position of Wing and Fuselage, by L. Prandtl. Translated from Ergebnisse der Aerodynamischen Versuchsanstalt zn Göttingen, by N.A.C.A.

6 A Mechanical Device for Illustrating Airplane Stability, by F. H. Norton.

7 A Preliminary Investigation of a New Method for Testing Aerofoils in Free Flight, by F. H. Norton.

8 Impact Tests for Woods, by Bureau of Standards.

79 Effect of Aerofoil Aspect Ratio on the Slope of the Lift Curve, by Walter S. Diehl, Bureau of Aeronautics, Navy Department.

80 The Dead Weight of the Airship and the Number of Passengers that can be Carried, by Col. Crocco. Translated from Rendiconti dell 'Istituto Sperimentale Aeronautico, September, 1920, by Paris Office, N.A.C.A.

81 Langley Field Wind Tunnel Apparatus. Pt. I, Regulators for Speed of Wind Tunnel Drive Motor. Pt. II, A Vernier Manometer with Adjustable Sensitivity, by D. L. Bacon.

82 Notes on the Construction and Testing of Model Airplanes, by Walter S. Diehl, Bureau of Aeronautics, Navy Department.

83 Theory of the Propeller, by A. Betz. Translated from the German by the N.A.C.A.

84 New Data on the Laws of Fluid Resistance, by C. Wieselsberger. Translated from the German by N.A.C.A.

85 Air-Force and Three Moments for F-5-L Flying Boat, by Aeronautics Staff, Construction Department, Navy Yard, Washington, D. C.

86 Surface Area Coefficients for Airship Envelopes, by Walter S. Diehl, Bureau of Aeronautics, Washington D. C.

87 Hydrostatic Test of an Airship Model, by Aeronautics Staff. Construction Department, Navy Yard, Washington, D. C.

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89 The Choice of the Speed of an Airship, by Max M. Munk, N.A.C.A.

90 Syphon Diagrams. Methods for Predicting their Performance and Purposes of Instrument Design, by H. N. Eaton and G. H. Keulegan, Bureau of Standards.

91 Notes on Propeller Design—I: The Energy Losses of the Propeller, by Max M. Munk, N.A.C.A.

92 Full-Scale Determination of the Lift and Drag of a Seaplane, by Max M. Munk, N.A.C.A.

93 The Background of Detonation, by S. W. Sparrow, Bureau of Standards.

94 Notes on Propeller Design—II: The Best Distribution of Thrust over a Propeller Blade, by Max M. Munk, N.A.C.A.

95 Notes on Propeller Design—III: The Aerodynamical Equations of the Propeller Blade Elements, by Max M. Munk, N.A.C.A.

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97 N.A.C.A. Control Position Recorder, by F. H. Norton, L.M.A.L.

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98 Notes on the Design of Latticed Columns Subject to Lateral Loads. By Charles J. McCarthy, Bureau of Aeronautics, Navy Dept.

99 Notes on the Standard Atmosphere. By Walter S. Diehl, Bureau of Aeronautics, Navy Dept.

100 Theory of the Slotted Wing. Lecture by A. Betz. Translated from "Berichte und Abhandlungen der Wissenschaftlichen Gesellschaft für Luftfahrt," No. 6, 1922 by N.A.C.A.

101 Comparing Maximum Pressures in Internal Combustion Engines. By S. W. Sparrow and Stephen M. Lee, Bureau of Standards.

102 Skin Frictional Resistance of Plane Surfaces in Air. Abstract of Recent German Tests, with Notes. By Walter S. Diehl, Bureau of Aeronautics, Navy Department.

103 Simple Formula for Estimating Airplane Ceilings. By Walter S. Diehl, Bureau of Aeronautics, Navy Dept.

104 Notes on Aerodynamic Forces—I. Rectilinear Motion. By Max M. Munk, N.A.C.A.

105 Notes on Aerodynamic Forces—II. Curvilinear Motion. By Max M. Munk, N.A.C.A.

106 Notes on Aerodynamic Forces—III. The Aerodynamic Forces on Airships. By Max M. Munk, N.A.C.A.

107 Structural Safety during Curved Flight. By A. Rohrbach. Translated from the German by N.A.C.A.

108 The use of Multiplied pressures for automatic altitude adjustments. By Stanwood W. Sparrow, Bureau of Standards.

109 The Twisted Wing with Elliptic Plan Form. By Max M. Munk, N.A.C.A.

110 The effect on rudder control of slip stream, body, and ground interference. By H. I. Hoot and D. L. Bacon, L.M.A.L.

(Concluded from page 602)

the afternoon several of the planes held a thirty mile race. Mr. and Mrs. T. Ellwood Allison entertained the army and navy officers and the officials of the Aero Club at a luncheon at their home near the field.

Rear Admiral L. M. Nulton Commandant of the Philadelphia who attended with his staff also made an address.
W. H. Sheahan,
1st Vice President.

(Concluded from page 600)

compartments for the occupants, filled with fresh air of sea level density and there will be noticed no more discomforts than those of the every day Pullman while the advantages of air travel are startling. No click of the wheels over rail joints, speeds with trade winds of 200 or more miles an hour, no noise but the rush of air, no changing, panorama of Brobdingnagian proportions spreading out below.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

American Gliding Contests

IN ANSWER to an invitation extended by the Chamber of Commerce of Daytona, Florida, to the Aero Science Club of America, the first gliding and soaring flight competition in motorless airplanes in the United States will be held at the Ormond-Daytona Beach during next January. "The Aero Science Club of America has accepted," said Stanley Yale Beach, its secretary, to-day, "and has forwarded the invitation to the Aero Club of America and the National Aeronautic Association. The Aero Science Club will be glad to conduct the meet and hopes for an unequalled participation. We hope to make some new world records in gliding flight. The contest will be open to everybody. Motorless flying is true flying and nothing could be more effective in stimulating interest in aviation."

In the invitation from the Daytona Chamber of Commerce received yesterday it was stated that a thousand dollar trophy had been donated for the first American contest. It is hoped to add substantially to this inducement by other trophies and cash prizes. The National Aeronautic Association has expressed its interest in the matter and has given its assurance of co-operation.

The invitation was extended by the Daytona Chamber of Commerce after consideration of a report on the suitability of the Ormond-Daytona Beach for the proposed contest.

"In considering the enterprising offer of the Daytona Chamber of Commerce," said Mr. Beach, "the Aero Science Club of America took into consideration the fact that it would be necessary to wait until next summer if a meet were to be held near the great centers of population in the North. Such a delay would be deplorable in the face of the encouragement given to air flight in Europe. The Aero Science Club will urge the heartiest participation by all the Army and Navy fliers, airplane manufacturers, technical schools, independent fliers and its own members."

Although the Ormond-Daytona Beach has no hills such as were taken advantage of during the contest in Germany, sand dunes offer the finest place of all from which to glide, as was proven by the fact that all the early experimenters here, such as Octave Chaute, Avery, Herring and the Wright Brothers used them. Orville Wright was one of the first men to develop the art of gliding, although he has not flown a glider since he soared over a sand dune at Kitty Hawk for ten minutes in 1911 in a fifty-seven mile-an-hour gale.

As long as every one flies under the same conditions, it does not matter whether the starting point is high or not. To hold a competition it is only necessary to have a suitable spot. Without doubt, Ormond-Daytona Beach will be a first rate place to hold a contest for the reason that a strong breeze from the sea generally prevails in which some of the machines would be able to make true soaring flights.

In the event there is no breeze, trials can be made by towing by autos on the

beach, each glider being towed a certain distance and at a given speed. The same should be done on the Indian River for the sea planes, or off shore when the sea is smooth for such craft as will stand the waves.

Long soaring flights can be made on the coast as well as inland. The flight of Capt. E. P. Raynham, an English aviator, of an hour and fifty-three minutes on October 17th, the second day of the London Daily Mail contest, was made with a simple monoplane of his own construction. Captain Raynham came to the meet with little expectations. He had hoped to remain in the air for three minutes. He remained for almost two hours. So little did he expect to do any soaring that his controls were so inconveniently arranged that by the end of the flight he was quite exhausted from holding them.

It is possible to soar over the water in one of these gliders as well as over the land, as shown by the recent experiments of Glenn H. Curtiss the inventor of the flying boat. There are many who are eager to compete in a glider contest, and at Ormond-Daytona Beach they will have their chance.

Model "D" Orenco

Following is a description of the Model "D" Orenco built by a student of the Shenandoah Valley Academy, Winchester, Va.

Dimensions

Span upper	30"
Span lower	27½"
Gap	44½"
Chord	55"
Length o.a.	21½"
Height	8¾"
Propeller	9" dia. x 8½" pitch

Wings

The upper wing is built as one unit, the spars being continuous throughout the length of the wing. This plane is built up of 19 balsa ribs, in which holes were cut for the spars which were inserted, and the ribs spaced 1½" apart thereon. The front spar is centered 13/16" from the leading edge, and the rear spar is 2½" from it. The front spar is 3/16" x 5/32", while the rear spar is slightly smaller, owing

to the narrowness of the ribs at that point.

Ailerons are on the upper plane only, and these measure 7/8" x 1¼". The spars at the ailerons are beveled, providing a much neater hinge.

The lower planes are built up of 8 ribs each, and both wings have an edging of reed slightly less than 3/32" in diameter.

All of the struts are streamlined, and the fastenings for the wires are of aluminum, but a couple of turns of No. 32 gauge steel wire about the spar at each connection will be found much stronger and efficient, although it does not look as much like the real thing.

The covering is of very fine silk, doped and varnished. Wing section used is U. S. A. No. 15.

Fuselage

This is constructed in the usual way. At the rear, a permanent fastening is made of the tail-skid and a rear post for the fin, thereby eliminating wires from the empennage.

The pilot's head-rest is of aluminum, as is the cowl containing the cockpit forward to the motor. Here balsa wood has been used, cut to the form shown in the photographs, by which the outline of the dummy Wright motor could be most easily adhered to. Small paper tubes are used to simulate exhaust pipes.

The radiator is cut from soft pine, and may be taken out. It is attached to the motor-stick, whose only other connection with the body is made by a piece of #34 wire about the center of the upper cross-piece at the back of the cockpit. Ten strands of 1/16" square rubber proved to be of enough power to fly the model R. O. G.

A piece of aluminum forms the under cowl, extending from the radiator as far back as the entering edge of the lower wing.

A small cap of balsa was placed on the propeller hub recently, which is not included in the length of the fuselage as given above.

Landing Gear

This is made of spruce, and is ½" x ¼" except about the axle, where the joint was made at the vertex of each "V", and the



Model "D" Orenco built by an Aerial Age reader

proper curve required a greater width. A rounded oblong hole $1\frac{1}{3}'' \times \frac{1}{2}''$ is provided for the floating axle, which is held in position by small rubber bands. Two cross-braces are used, also streamlining the axle.

The wheels are $2\frac{1}{4}''$, covered with fabric and doped, being perfectly flat on the inside, but the fabric raised $\frac{3}{8}''$ at the hub on the outside.

The tail-skid fairing is balsa, while the hinged skid itself is of hard-wood with rubber shock-absorber.

Empennage

The fin is fastened to a post $\frac{1}{8}''$ square which is attached permanently to the fuselage, and is made up of balsa wood $\frac{1}{8}''$ thick and is covered and doped.

The rudder is made up in the usual way, with an edging of $3/32''$ reed, except that the upper rib which forms the lower edge of the balanced portion is built of two pieces of thin spruce $\frac{1}{8}'' \times 1/32''$, one of which goes on either side of the $\frac{1}{8}''$ round bar forming the hinge of the rudder.

The stabilizer has only the forward spar continuous and running through the fuselage. Its ribs are of $\frac{1}{8}'' \times 1/32''$, and pass on both sides of the spar, meeting at the entering and trailing edge, giving it a double-cambered surface, as in a portion of the rudder. It is adjustable, and has $3/16''$ play at the entering edge, as the spar is the only piece which enters the body.

The elevator, being single acts as a good brace for the rear of the stabilizer. It is easily built of one $\frac{1}{8}''$ round bar at the front, and edged with $3/32''$ reed, held in place by four $\frac{1}{8}''$ square balsa strips.

General

The entire fuselage, fin, and balanced portion of the rudder are given a coat of olive-drab enamel. The machine has the regulation U. S. Army insignia.

All doped surfaces, stabilizer, elevator, wings, and wheels, and all exposed wood, i. e., struts, landing-gear and propeller, are Valspared. Recently, however, the wings, elevator and stabilizer were enamelled cream.

The performance last summer proved far better than the builder had expected; it won first place among other scale models of the C. M. A. C. in Washington. It seemed balanced almost perfectly without moving the wings in the slightest, or changing the position of any of its surfaces, which is somewhat unusual for a scale model in which all dimensions of its prototype have been strictly adhered to. One great help is the solid block of balsa in the nose above the top longerons.

In flying against a 6 or 7 mile wind, its tail rises almost immediately, and it is off the ground before it has run 15 feet. It then rises at a good angle, and when the power gives out, lands easily.

aeroplane, when the motor is stopped becomes a natural gliding machine, and while tending always earthward it may travel forward in straight or circling paths at a rate of 8 feet for each foot of elevation. In other words, it moves forward eight times as fast as it does downward, assuming an angle of descent in that particular relation. Therefore a flat gliding path is desirable in any machine as it makes possible a wider choice of landing territory.

A glider, or aeroplane in which the motor is stopped, must descend at a rate of speed not less than that determined by its lift in relation to its weight, although for making a landing at predetermined places, within gliding distance the control surfaces permit of increasing this angle at will. In this manner, the angle of descent may be said to be variable, altho having a definite minimum angle.

With this in mind, it is easily seen how the gliding angle effects the range of action of an aeroplane in coming to the earth—a plane with a gliding angle of only 6 to one, beginning a glide at 100 feet, has available to itself a circular plot of ground 1200 feet in diameter, that is, 600 feet in radius, in which to affect a landing. On the other hand, a machine capable of gliding at an angle of 8 to one has a wider choice in selecting its landing place, as it may glide to any point within a 1600 foot circle below. Taking this 100 foot altitude for a comparison of two ships as this, we find that the plane which glides at 8 to one actually has — square feet more of ground in which to land. The amount of territory included by the flat-angle glider is proportionately greater from higher altitudes.

In gliding experiments, the glider is launched from an altitude, preferably a sloping hillside. Gravity carries it downward as it glides forward. Balance is maintained by the operator shifting the weight of his body slightly from side to side or fore and aft. In the more proficient gliders, controls similar to the conventional aeroplane are used.

A glider, then, may travel not further than a definitely fixed distance which is determined by its weight and altitude. Its field of operation is therefore limited.

There is another form of glider which has recently come to public notice. This is the "towed" glider—one which is towed through the air by means of a powered vehicle. Glenn H. Curtiss has designed a glider of this type. It has been successfully towed by a high speed motor boat and on another test was towed by a flying boat. The tests showed that "air-trailers" may become an important factor in future development of the glider.

Where a glider is towed through the air, the force which pulls the machine forward takes the place of the power supplied by gravity, and inasmuch as the pulling force is forward instead of downward (as in the case of gravity) greater lift is obtainable, and therefore horizontal and even lifting flight may be accomplished as long as the pulling force continues. As soon as the towing wire is released, and the forward pull discontinues, the "air-trailer" becomes a true glider and descends slowly under the influence of gravity gliders or "air-trailers" may be developed into soaring planes or "sail-planes", the characteristics of which are exceedingly more complex.

The "Soaring Plane"

The soaring plane may travel in all dir-

Gliding and Soaring Flight

The gliding and soaring flights occupying the attention of Europe and America are the modern experimenters best means of bird-flight study. Gliding was practiced in the early days of aeronautics as the first step toward flying. When the motored glider or aeroplane became a reality, gliding was for a time quite abandoned as merely an elementary principle which needed no further development. Now it may seem odd for even professional pilots again taking up the sport of gliding and its later development, soaring, yet there are very good reasons for the return, as we shall see.

Perhaps the greatest benefit to be derived by the accomplishment of true soaring flight is economy of power. Now altho man soon learned to fly through the air faster than any bird, the fact remains that man requires considerably more power in proportion to his accomplishment in speed. Of course the original problem was to fly at no matter what cost. Once the pioneers of aviation demonstrated that flight was possible, the tendency was to increase the speed of flight. It was found that for motored flight that safety lies in speed, up to a certain point. Therefore we have had speed development, best evidenced in the army Curtiss Racer which flies at more than four miles a minute.

It is not supposed that the glider, or soaring "sail-plane", will supplant the modern aeroplane any more than yachting would be expected to do away with the motor boat. But each has a purpose to serve.

To return to the early use of the glider—man learned to balance himself in the air, found out about air currents and the effects of the atmosphere on his craft and tested the value of various bird-like wing structures. When the powered glider came into existence, attention was directed principal-

ly toward perfecting the engines and the controlling mechanisms. Much research into the fundamental principles underlying flight was set aside in many instances because of the pressing demands of physical development. This is clearly brought out in the fact that from the time of the first flight, aircraft development made considerably greater progress in the same period of time than the automobile industry.

We are approaching the limit in speed for aircraft of the type we are familiar with today. Still there remains the economy factor, and it is through our gliding and soaring experiments that we must look for the solution of the low powered air vehicle which will rival the automobile in economy, ease of maintenance and operation.

In order to appreciate the problems and difficulties confronting the designer of motorless aircraft, it is well to touch upon some of the distinctions, principles, laws governing the various types of craft under consideration.

The Glider

The glider is the simplest form of aircraft. It comprises a surface which retards the downward movement caused by gravity, resolving it into a forward movement. In a glider, the path of flight is continually downward and forward due to gravity and pressure of air on the wings respectively. The most efficient glider is that in which the rate of descent is slowest. The gliding angle, therefore, is the angle of descent, and the greater this angle, the better the glider, for it means that greater ground may be covered in descending from a given altitude.

Birds glide at the rate of about 12 to 1; that is, for each foot of elevation, the bird skims forward 12 feet, with no power other than the action of gravity. The modern

ections, with or against the wind. It may rise and dip as various air currents are encountered. Altho it is acted upon by gravity, the peculiar forces utilized by its wings has greater effect than gravity, thereby making lifting possible.

All concurring air flows around a wing, (as the wings of a soaring bird) is not known, but there are some basic laws and phenomenon at the disposal of the sail-plane designer. Tests have shown the paths followed by air passing around a wing surface. Wings of differing contours, direct the air flow in different ways, some in such a way that they cause more lift than others.

The lifting effect is produced by the distribution of air flow over the wing. The top side of a wing is arched, with its highest point near the front. Air passing over the wing (or the wing passing through the air, which has the same effect) is divided, some being directed above the wing and some below it. The air in passing over the curved upper surface is, we might say, "thinned out" or rarified to some extent. The air below the wiry curve remains at about the same density, and therefore the result is that the wing finds less resistance above than below, and lifting occurs. The phenomena is really more complicated than this explanation might indicate, but it gives a general idea

of the function of the curved wing.

It will be seen, then, why so many wing contours have been experimented with. Each has its own peculiar traits and constant research is necessary to determine the contour most suitable to the work at hand.

As the lift required for soaring is derived from the movement of the air, naturally there can be no soaring in calm air. As soon as all movement of air ceases soaring quickly ceases and only gliding is possible. This explains the reason that certain localities have been selected by the German soaring plane experimenters, hilly places where air currents are almost continually in motion.

Air currents heated by the sun's rays reflected from the earth, seems to help the lift of a soaring plane. It is a fact that in warmer climates, birds are observed to soar continuously all day, depending absolutely on the air currents which becoming heated and rise, thereby giving motion to the air which in turn imparts the necessary lift to the wings. Soaring birds are unknown in cold climates. It has been observed that soaring is less common as darkness approaches in temperate climates, strengthening the theory that warm air currents are an important requisite for soaring.

(To be continued)

A Model of the Avro "Baby" Aeroplane

The model of the Avro "Baby Green" aeroplane was made from plans appearing in AERIAL AGE, September 1920 by Bruce Allan Mapes of Brooklyn. This ship won the London Aerial Derby, of that year and also flew from London to Turin, Italy a distance of 650 miles in 9½ hours, using only 20 gallons of petrol.

Dimensions of model:

Overall Length	26½"
Overall Height	10½"
Wingspread	37¾"
Wing Chord	57⅝"



Above: An Avro "Baby" model by Bruce Mapes Below: A 5 H.P. air-propelled ice sled built by H. B. Tonking.

Gap	6¾"
Size of Prop. Diam.	12"
Size of Wheel	3"
Weight	12 ounces
Wing Curve	Sloane

The fuselage is built up from 5/32" longerons of spruce, and made in the standard fashion. I made the fuselage extra strong to stand a good deal of knocking around. The Turtle Deck is built up of Balsa wood framework. Forty feet of ⅛" flat rubber supply the motive power. The landing gear is made from ¼" round reed, with a streamline fairing of Balsa wood. Three inch wooden disc wheels with rubber tires are used with 1/16".

The outside of the wheels are covered with very thin silk and doped. This gives a very good streamline effect. The method of doing this is: the rubber tire is removed and glue or shellac is put on around the rim where the tire was. Spread the silk over the wheel and put on tire again. When the tire is on pull the silk through the opposite side and stretch it evenly all around. When the glue has set, dope the silk several times and you will have a fine streamline disc wheel. This may be done on both sides. The landing gear is also shock absorbing. The nose piece is painted on to correct form. The radiator cowling being painted on. The radiator is put on with white ink, on a black piece of cardboard. This is glued on the front, and then the radiator cowling being painted all around gives it a good effect. A twelve inch propeller is used.

The tail group is constructed in the usual manner with 3/32" reed for the edges, and ⅛" square pine for the frame work. The tail surfaces are movable but not from the pilots cockpit, as in any other models. The tail skid is of ¼" round reed.

The wings are made up of 3/32" reed for the leading and trailing edges, ribs being made of Balsa wood, with Sloane

Wing Curve. The ribs of the middle wing is for strength. The wing spars are of ⅛" section and ribs fastened next the fuselage, are made of 1/16" three ply veneer. This spruce, slipped through holes in the ribs at the correct points and glued in place. There are 8 ribs in each lower wing and 7 in each upper wing, and four ribs in the M. W. S. The struts are ⅜" x 3/32" spruce and streamlined. The middle Wing Section Struts are raked outward. The wires are really very thin fishing cord. I think this is better than wire, and is neater and stronger, it is always taut.

The entire model is covered with bamboo paper, and doped with bamboo varnish. The cowling, landing chassis, tail skid and all struts are finished in light blue, the rest of the machine in natural color. The total weight is 12 ounces.

Models Built by Aerial Age Readers

The Curtiss JN4-D model built by R. Hopkins, E. 6th Ave., Redfield, S. D., is not intended to fly but the construction of the large machine is carried out in detail. It was built to the scale of an inch to the foot.

The wings are made in five sections. Spars are of spruce, the ribs are of basswood and are webb construction to secure lightness and to take internal bracing wires. Three-ply veneer is glued to the entering edge of the wings to make it rigid at these points and to keep the covering from pulling in between ribs. Each upper plane is composed of 18 ribs and each lower 14 ribs. There are two stringers thru each wing to secure stiffness. The wings are covered with silk and finished a light brown.

The inter-plane bracing is the same as on the large machine.

The fuselage is built up like the large machine and braced internally with wire, using small aluminum fittings painted black. Seats are leather-padded and have safety belts with small buckles. The following instruments are mounted upon the mahogany instrument board in the rear cockpit: clock, compass, tachometer, air-speed indicator, altimeter, and oil gauge.

In the rear cockpit there is a throttle lever, switch and hand operated pump that will really pump. The gasoline tank is made of three pieces of brass joined by soldering. A miniature gasoline gauge screws on the tank above the cowling. Edges of the cockpits are padded with leather.

The engine is a dummy OX-5 and is mounted in the engine bed by four small bolts. The crankcase is of wood. The cylinders were made out of rifle bullets of the type used in the army. Small valves and rocker-arms were soldered on the tops. The exhaust pipes are of brass tubing. Intake pipes and a dummy magneto are mounted between the cylinders. Cylinders and crankcase are painted aluminum. The engine cover can be easily removed by unhooking four small lips which hold it tight. The inspection doors swing on two aluminum hinges and are held closed by aluminum clips.

The propeller is eight inches in diameter and is made in five laminations. Radiator is of wood painted gold, the radiating surface being lined with ink.

It is equipped with dual controls. Each elevator aileron and the rudder are hinged by three aluminum hinges. The control horns are of aluminum.

The tail skid and under-carriage are equipped with elastic shock-absorbers.



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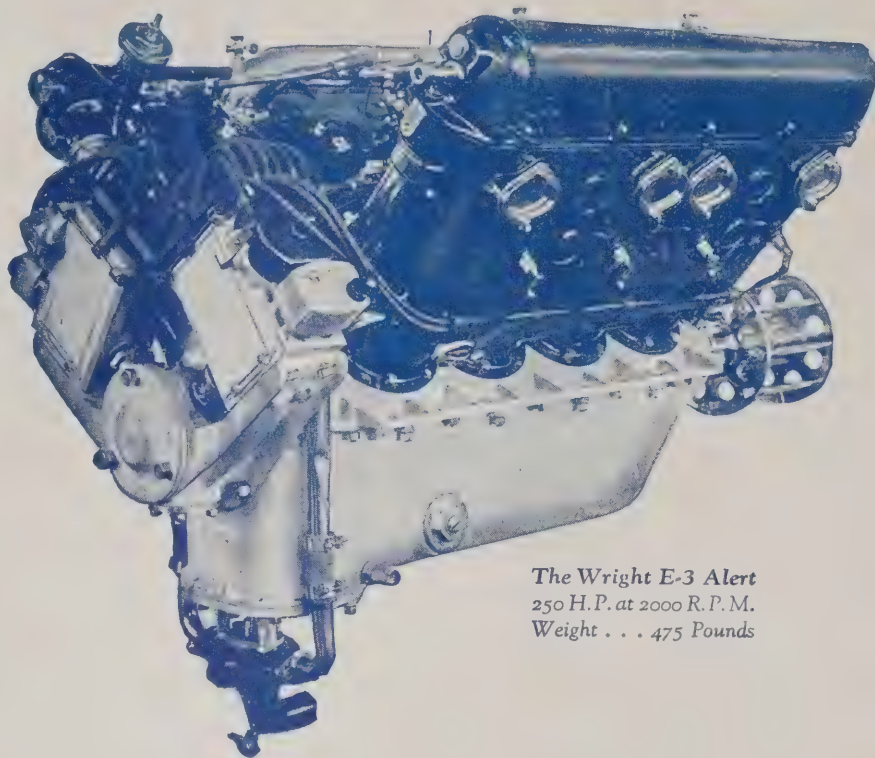
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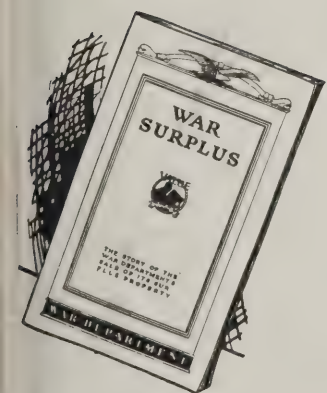
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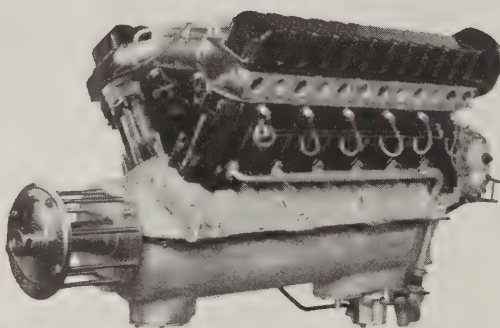


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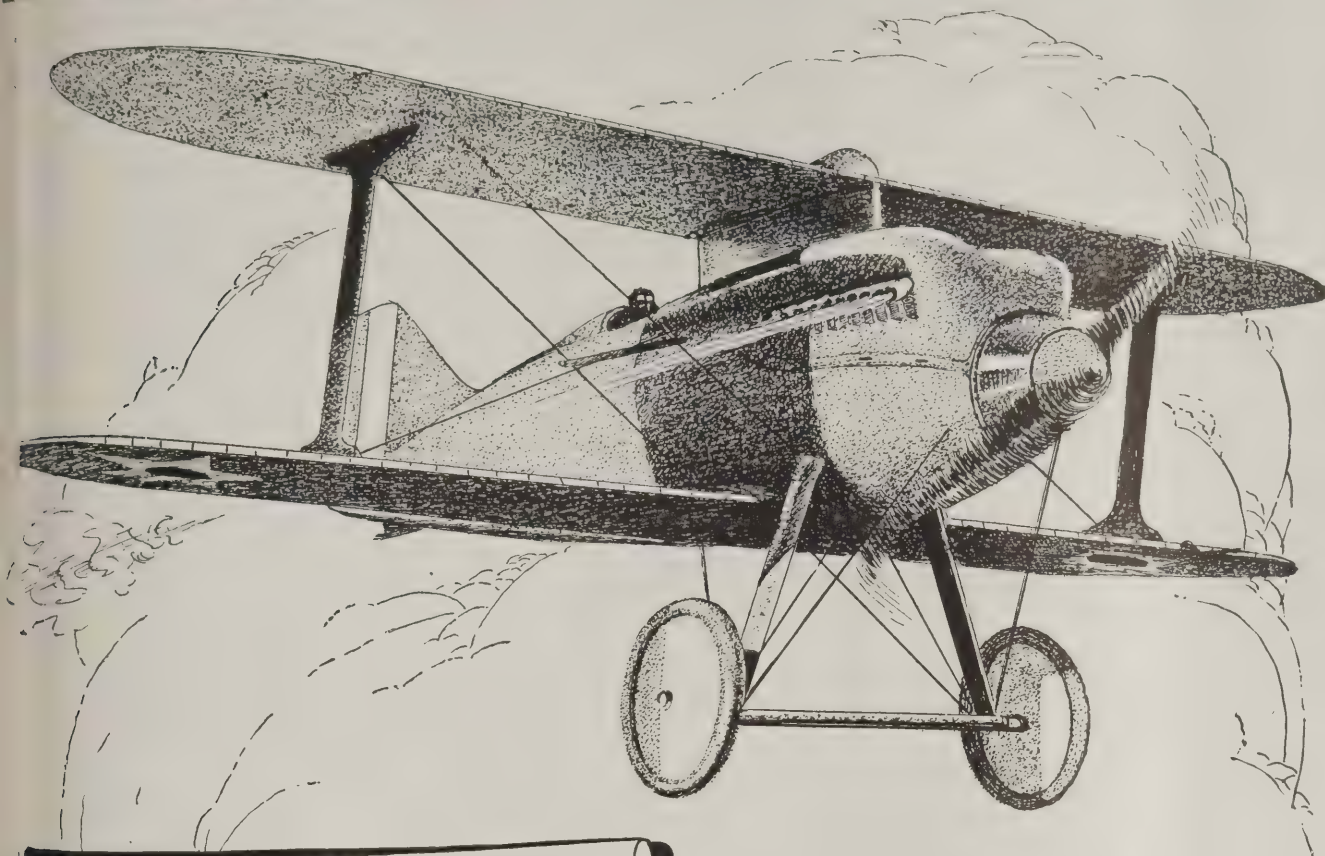
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Edition of 1922

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 250 Pages Text; 40 Pages Illustrations; 40 Pages Aircraft and Engine Drawings
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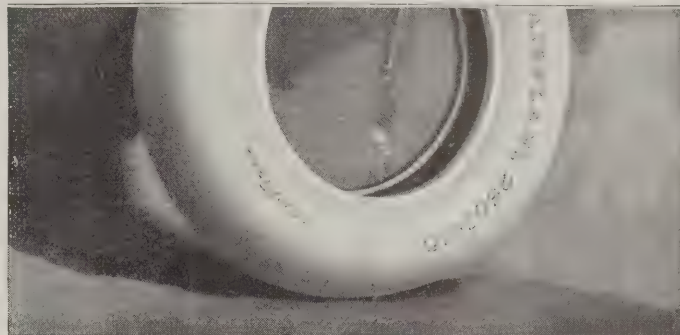
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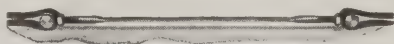
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